THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

VOL. XXVIII. COLOMBO, MAY 15TH, 1907. **No. 5.**

Co-operation in Agriculture.

We may be forgiven for returning once more to this subject, for it is one of the most important in connection with agriculture. It is by no means necessary that co-operation should be simply for the supply of money—by Co-operative Credit Societies. In fact, judging from Indian experience, where the money borrowed is at times spent on weddings or other festivities, it is rather doubtful if this is the best way of working. Rather the co-operation should be in the supply of seed—paddy, for example, is already supplied by two or three local Societies in Ceylon—manure, or other things which are generally needed for the carrying on of agricultural enterprises, or for the sale of the products of those enterprises, as in the case of Vavuniya, where they are sent fortnightly to Colombo, and even after subtracting the cost of freight, realise better prices than they would if sold locally.

It is almost needless to remark that in most places in Ceylon the word co-operation can only be used in a general sense. The villagers alone, in any particular village or district, if required to co-operate and find money, would be like the inhabitants of the famous island who eked out a precarious living by taking in one another's washing. The capital required to start any undertaking must be otherwise found, but after that there is no reason that we can see why complete co-operation should not come in.

Articles dealing with the working of co-operative societies in other countries have been given in many numbers, and we shall not let this subject drop till it is in a fair way of being taken up more thoroughly in Ceylon.

GUMS, RESINS, SAPS AND EXUDATIONS.

CEYLON PARA RUBBER.

In drawing comparisons between Ceylon Para and Brazil Para regarding their respective keeping qualities, G. v. d. Kerckhove, in the "Gummi Zeitung," recommends coagulation by smoke for the former as is employed for the latter. He further affirms that Amazon Para is of a more elastic nature than Ceylon Para, and that it is less liable to become damaged. As long as the consignments of Ceylon Para are small, the quality of the product remains satisfactory; it is when the quantity is increased that heat is developed, with its consequent injury to the rubber. By coagulating the latex of the Hevea obtained in Ceylon by smoking as in Brazil, the author maintains that the keeping qualities of the Ceylon Para would be greatly increased. Ceylon Para being an extra pure, but very dry, rubber, by reason of the way in which the latex is coagulated, is more easily influenced by heat, pressure in packing, long stocking, etc., than other rubbers, as most rubbers containing a little moisture keep better than the extra dry sorts. A rather different is held by Dr. Esch, who is of the opinion that a smoked rubber keeps better when dried somewhat. According to his experience, Ceylon Para is not subject to over-heating, but if insufficiently cleaned and badly preserved it acquires an objectionable smell, which must not be confused with over-heating. If Ceylon Para, when properly prepared, has an inclination to become heated, it is quite as likely that signs will be given of it in small parcels as in large. Perhaps rubber from the ficus trees, which has a known tendency to appear over-heated, has been confused with Para rubber. The Ceylon method of coagulation has been praised by French experts, and the writer considers that a good, properly cured Ceylon Para is equal in elasticity and durability to Amazon Para. The cause of over heating has been ascribed to the presence of albuminoids, so in selecting chemicals to bring about coagulation choice must be made of those which retain these bodies in solution. In conclusion, Dr. Esch states that the uses to which Ceylon Para is put speak highly for its elasticity; further, this rubber vulcanizes with equal facility to Amazon Para, and he has never found it to retain more than 3 per cent. of resin.—*India Rubber Journal.*

[So far as we have been able to find, the great use of Ceylon and Straits rubber, clean and dry as it is, is, as we pointed out would be the case some years ago, for solution, and when that market is overstocked, there must be a fall in price. But already the new "wet block," though only in its infancy, is meeting with great avour. One manufacturer says that it is "practically fine hard Para, and he desires nothing better," while a recent large consignment of Vallambrosa wet block, smoked on the outside to preserve it, and containing 11 per cent of moisture, sold for 5s. 10d., per lb. a price as good as 6s. 6½d. for biscuits.—Ed.—*T.A.*]

PROSPECTS FOR GUAYULE RUBBER.

The great drawback to the extensive employment of guayule rubber has been the large percentage of resin it contains, great difficulties being encountered in extracting the rubber, together with the elimination of the attending resins. Added to this defect are other objections, namely, its high proportion of ash, the invariable presence of large quantities of organic impurities, and finally, its intense smell. At the same time, however, the pure rubber exhibits all the properties and attributes of the best qualities. But it would appear that the employment of guayule rubber is now emerging from the experimental stage into one of high practical utility. In giving a detailed account of the history of this product up to its most recent

devlopment, a contributor to the "Gummi Zeitung" relates that the natives of Mexico have long known that the plant locally known as "Yerba" or "Yule," was a rubber producing plant. The first means employed to extract the rubber was by chewing; this naturally had to be abandoned as most impracticable. Solvents such as carbon bi-sulphide and naptha extract too much resin, whilst an alkaline and acid treatment is equally unsatisfactory. Subsequently a firm, under the style of "Compania Explotadora de Caucho Mexicana," erected works, and by means of a special process, details of which were kept secret, placed considerable quantities of guayule rubber on the market. The washed and dried gum, however, still contained from 10 to 20 per cent of resins and wax, and from 2 to 6 per cent. of ash, besides this it still retained its characteristic colour. The chief drawback in the presence of the resins, however, was not so much the quantity as their peculiarly objectionable qualities which render the rubber very difficult to work. Proceeding, however, in their endeavour to improve this raw rubber, the above mentioned company have recently succeeded in preparing guayule rubber of a clear yellowish grey colour, clean and odourless, which works well on the rollers, and upon analysis was found to have the following composition: Resin 1·06 per cent., rubber 98·31 per cent. This product far excels other sorts of guayule rubber, and, it is maintained, is suitable for the production of the finest rubber articles without exception. The writer states that the C. E. de C. M. are taking the necessary steps to place large quantities of this rubber on the market, and hope to produce from their works, now in course of construction in Sattilo (Mexico), about four tons daily. Accordingly, in consequence of the high degree of purity and its excellent physical properties, it is anticipated that this new quality will constitute an article of great importance to the rubber industry.—*India-Rubber Journal.*

Rubber in East Africa.

The following Official Reports on the Rubber Industry are of interest:—

Zanzibar, June 19th, 1906.

SIR,—With reference to your Circular (13123) in this series dated April 28th last, I have the honour to transmit herewith two memoranda on the cultivation of rubber in Zanzibar and in German East Africa, which have been prepared by Mr. Vice-Consul Sinclair and Mr. Vice-Consul Venables, respectively.

I have etc.,

(Signed) BASIL S. CAVE.

To the Right Hon. Sir Edward Grey, Bart., M.P.

THE CULTIVATION OF RUBBER IN ZANZIBAR.

The amount of rubber produced by these islands is at present insignificant, nor, owing to the limited area in which it could be grown, is it ever likely to become an important item of export. All that there is, is derived from Llandolphia vine which is indigenous in the island of Pemba, growing wild in the small forests at the north end of that Island.

About six years ago the Department of the Director of Agriculture made some nurseries of young plants with the object of planting up the forest-land, native rangers were appointed to prevent the destruction of the vines, and a system of alternately resting parts of the area was established. The result was that in 1903, 2,316 lbs. were brought in as against 763 lbs. in 1899, but owing probably to heavy clove crops, the gathering of which drew away the natives who would otherwise have been employed in collecting rubber, the exports fell to 1,682 lbs. in 1904 and to 816 lbs. in 1905.

The total area suitable for rubber does not exceed 10,000 acres, but the present production might be considerably increased by the planting up of those parts of this area which are at present unproductive.

Llandolphia is not indigenous in the Island of Zanzibar, but experiments in the cultivation of four exotic species., viz., Para rubber, Ceara rubber, Central American and Ficus Elastica, which have been made at the Government plantations at Dunga show that, although all of these grow well, they do not, probably owing to the lightness and porosity of the soil, yield much latex. The Ceara species which is very easily cultivated, growing rapidly from cuttings, is being used as a shade for vanilla.

Rubber is collected by the natives of Pemba by slicing off chips of the bark of the vine from the bottom upwards, and applying salt water to the wounds when the latex quickly coagulates and is easily peeled off and rolled into balls weighing about one pound.

Under a regulation that was issued in order to put a stop to the practice of rolling the rubber round a nucleus of a stone, and of mixing in sand, all rubber balls now have to be cut in halves before passing the customs.

The export duty is fifteen per cent *ad valorem.*

THE CULTIVATION OF RUBBER IN GERMAN EAST AFRICA.

The cultivation of rubber in German East Africa is of comparatively recent introduction, though the produce of the indigenous varieties has, almost since the foundation of the colony formed an article of export of more or less importance.

EXTENT OF PLANTATIONS.—At the present moment the total acreage of the rubber plantations in various parts of the German Protectorate does not exceed 1,200 acres. These plantations are mostly situated in the lowlying country of the Northern districts, but experimental planting at various altitudes throughout the colony has yielded not unpromising results.

MANIHOT GLAZIOVII.—For practical purposes the cultivation of only one class of rubber, namely, the *Manihot Glaziovii* (Ceara Rubber) has so far been carried on to any considerable extent. This species does not appear to have any very special requirements as to soil, and equally good results have been obtained from its cultivation in all parts of the Colony. As a general rule it has been found that the land will carry from six hundred to nine hundred trees to the acre. and that trees of from three to four years' growth may reasonably be expected to yield three and a half ounces of dry rubber per tree per annum, although at the experimental stations at Amani over seven ounces have been obtained. The trees attain a height of about 16 feet after 8 months or a year's growth.

OTHER VARIETIES.—Systematic experiments with respect to the cultivation of other species of rubber are constantly being made at the Agricultural Institute at Amani, and fair results have been obtained from the following kinds :—*Kickxia elastica*, *Mascarenhasia elastica*, *Castilloa elastica*. *Hevea brasiliensis*, and *Ficus elastica*. The last three especially have shown good promise in the lowlying districts of the Sigi Valley near Tanga.

Endeavours are being made by the Agricultural Department in German East Africa to induce the planters not to confine their attention exclusively to the *Manihot glaziovii*, but to interest themselves also in the higher grade rubbers, such for instance as the *Hevea Brasiliensis* (Para rubber), as the increasing output of high class rubbers in various parts of the world may ultimately place at a disadvantage such plantations as only cultivate the less valued varieties.

EXPORTS.—The total exports of rubber from the German East African Protectorate amounted last year to 337 tons, the value of which was computed at about £11,000. As the Customs authorities, however, make no distinction in their returns between rubber obtained from the indigenous species in their wild state and that emanating from the cultivated plantations, it is impossible to say to what extent the latter contributed to these figures, but it is probable that the proportion is not large.

TAPPING AND COLLECTION.—The Director of the Agricultural Institute at Amani is engaged in an exhaustive series of experiments with a view to ascertaining the best method of tapping and collecting the rubber. These experiments are not yet complete, but so far it would appear that in the case of trees just arrived at maturity, the best results can be obtained by allowing a period of four days to elapse between each tapping.

The final results of the investigations above alluded to cannot fail to be of interest, and on their completion a further special memorandum on this subject might be considered useful.

The cultivation of rubber in German East Africa is, as will have been seen from the foregoing notes, still practically in its infancy, but the climate and other conditions would appear not unfavourable, and a prosperous future may be anticipated.

LONDON RUBBER MARKET.

LONDON, March 15th, 1907.—At to-day's auction, 527 packages of Ceylon and Malaya Plantation grown rubber were under offer, of which about 433 were sold. The total weight amounted to about 24½ tons, Ceylon contributing nearly 6½, and Malaya over 18 tons. There was a good demand for all descriptions at about last sales rates, though biscuits and sheet, where the quality was not quite up to the finest, were inclined to be slightly easier. Fine crepe was again the chief feature, both in the strip and block form, and the highest figure mentioned was 5s 10¾d, which was offered for some very pale block crepe from Linggi Estate. A parcel of nice clean Rambong crepe realised 5s. 0¼d., and there was a good enquiry for scrap. Plantation fine to-day.—5s 8d to 5s 10¾d, same period last year, 6s 2d to 6s 3½d. Plantation Scrap.—4s 6d to 4s 8d, same period last year, 4s 11d, to 5s 3½d. Fine hard Para (South American).—5s 1¼d, same period last year, 5s 4½d. Average price of Ceylon and Malaya plantation rubber, 433 packages at 5s 5¾d per lb., against 121 packages at 6s 0½d per lb., same period last year. Particulars and prices as follows :—

CEYLON.

MARK.		QUANTITY, DESCRIPTION AND PRICE PER LB.
Ederapolla	1 case	good biscuits, 5s. 7¾d.
Kepitigalla	27 do	fine amber sheet, 5s. 8¾d ; 1 case good palish to darkish biscuits, 5s. 8½d.
C.L. (in diamond)	9 do	darkish crepe, 5s. 4½d. ; 11 cases dark, 5s 3d ; 1 case black pressed crepe, 4s 10¾d ; 3 cases fine pale scrap, 4s 7¾d ; 5 cases little darker 4s 7d.
Ellakande	1 do	good pale and darkish biscuits, 5s 8½d ; 2 cases good scrap, 4s 7½d ; 2 cases dark pressed crepe, 5s 3¾d ; 1 case black 4s 7d ; 1 case fine palish biscuits, 5s 8¾d.
Llangsland	11 do	fine palish to darkish biscuits, 5s 8¾d ; 2 cases scrap and rejections, 4s 8d.
J.V.V. & Co	3 do	low scrap, 4s 8d ; 1 case darkish scrap, 4s 7¾d,
Glanrhos	5 do	good palish to darkish biscuits, 5s 8¾d ; 12 cases good darkish crepe, 5s 4¼d.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Ambatenne	3 cases good darkish biscuits, 5s 8½d.
Palli	4 do good Ceara biscuits, 5s 8½d; 3 cases ditto sheet, 5s 8½d; 1 bag rejections, 2s 2d.
Densworth	2 do good darkish biscuits, 5s 8½d; 1 bag good rejections, 4s 5d; 1 bag fine pale scrap, 4s 8d; 1 case barky scrap, 4s 5¼d; 1 bag low scrap, 3s 3d.
Ambanpitiya	1 do good biscuits, 5s 8½d.
Talagalla	3 do good darkish biscuits, 5s 8½d; 3 cases good pressed scrap, 4s 7½d.
Ayr	1 do fine darkish biscuits, 5s 8½d.
Taldua	4 do good dark biscuits, 5s 8d; 1 case good scrap, 4s 7½d.
Sorana	1 do very fine palish biscuits, 5s 8¾d; 1 case similar, 5s 8¾d; 1 case good darkish, 5s 8½d.
Waharaka	1 do good dark biscuits, 5s 8¼d; 2 cases low scrap, 4s 7d.
Rangbodde	1 do exceptionally fine pale biscuits, 5s 9¼d.
V.B.	1 do fine amber sheet, 5s 8½.

MALAYA.

Highland Est.	18 cases fine washed sheet, 5s 8½d; 10 cases fine palish crepe, 5s 6¼d; 9 cases little darker, 5s 4¼d; 6 cases dark, 5s 2¾d; 3 cases brown 5s 3d; 12 cases fine palish washed sheet, 5s 8½d; 6 cases darker, 5s 8½d; 7 cases fine palish crepe, 5s 6½d; 2 cases good darkish, 5s 5d; 1 case brown, 5s 3d; 2 cases Rambong, 5s 0¼d; 1 case pressed ditto, 4s 9d.
C.M.R.E. Ld.	33 do fine palish crepe, 5s 8½d; 12 cases fine palish to darkish, 5s 7d; 1 case good dark, 5s 2d.
Batu Tiga	2 do good palish to darkish biscuits, 5s 8½d.
V.R. Co. Ld. Klang F.M.S. (in triangle)	5 do fine palish to darkish crepe, 5s 5¾d; 2 cases good palish block, 5s 9¾d; 3 cases dark, 5s 3¼d; 5 cases darkish, 5s 2d, to 5s 3¼d; 32 cases fine pale crepe, 5s 8¾d to 5s 9d; 3 cases fine palish to darkish, 5s 7d; 6 cases dark block, 5s 3¾d; 4 cases paler, 5s 1¾d.
S.R Co	9 do fine amber sheet, 5s 8½d to 5s 8¾d; 5 cases fine pale and palish crepe, 5s 9d; 1 case palish and darkish, 5s 5d; 8 cases dark, 5s 2¾d; 1 case brown, 5s 4¼d; 8 cases black, 5s 1d.
E.B. & Co (in triangle)	3 do fine palish sheet, 5s 8¾d; 3 cases darker, 5s 8½d; 1 case fine scrap 4s 7¾d; 1 bag rejections, 4s 6d; 9 cases fine amber sheet, 5s 8½d; 8 cases darker, 5s 8½d; 1 case rejections, 4s 3d; 2 cases good scrap, 4s 8d; 1 bag rough sheet, 4s 4d; 1 case good dull sheet, 5s 8d; 1 case rejections, 4s 6d.
Linggi Plantations Ld.	3 do fine palish to darkish crepe, 5s 8d; 3 cases fine palish to darkish, 5s 8d.
Mc.I. (in diamond)	3 do good dark biscuits, 5s 8d; 1 bag rough biscuits, 5s 7¼d; 2 cases good dark scrap, 4s 7¾d; 2 cases thick uncured biscuits 4s 6½d.
J.E.	8 do fine amber sheet, 5s 8¼d; 1 case fine palish scrap, 4s 8d; 7 cases pressed scrappy sheet, 4s 7½d to 4s 8½d.
B. & D.	1 do good Rambong scrap, 3s 9d; 1 case good palish biscuits, 5s 6d; 1 bag Rambong, 3s 6d; 1 bag rejections, 4s 7d; 1 bag block crepe and pieces, 4s 4½d; 1 bag very fine pale sheet, 5s 9d; 1 bag rough sheet, 5s 3d; 1 bag rejections, 4s, 1 bag good rough sheet, 4s 9d.
B.M. & C. S.	1 do good palish crepe, 5s 7½d; 7 cases darkish, 5s 4d.
B.M. & C.P.	4 do good dark biscuits, 5s 7½d.
S.B.C. (C.K.C. in diamond	2 do fine amber sheet, 5s 8¼.

LONDON March 26th, 1907.—At to-day's auction, 428 packages of Ceylon and Malaya Plantation grown rubber were under offer, of which about 329 were sold. The total weight amounted to about 26¼ tons, Ceylon contributing about 5½, and Malaya over 20¾ tons. Competition was not quite so general as at the last auction, no doubt to some extent owing to the near approach of the Easter Holidays. Fine block was again in request, a large parcel from Lanadron Estate (Johore) realising from 5s 11d to 5s 11½d per lb., this being the highest price of the auction. The finest grades of crepe mostly changed hands at about last rates, but the lower kinds were somewhat irregular. Quotations for fine sheet shewed little change, but scrap was rather less enquired for. Plantation Fine To-day.—5s 7¾d to 5s 11½d, same period last year, 6s 2¾d to 6s 3¼d. Plantation Scrap.—4s 5d to 4s 7d, same period last year, 4s 5d to 5s 5d. Fine hard Para (South American).—5s, same period last year, 5s 5¼d¼. Average price of Ceylon and Malaya plantation Rubber 329 packages at 5s 6½ per lb., against 100 packages at 5s 11d per lb. same period last year. Particulars and prices as follows:—

CEYLON.

MARK.	QUANTITY, DESCRIPTION AND PRICE PER LB.
Kumbukkan	3 cases fine darkish biscuits, 5s 8d; 1 case good scrap, 4s 4d.
Sorana	2 do fine palish biscuits, 5s 8d, to 5s 8½d; 1 case darker 5s 8d.
Waharaka	2 do good dark biscuits, 5s 8d.
Doranakande	7 do good dark biscuits, 5s 8d; 3 cases fine palish scrap 4s 7d; 2 cases rejections, 4s 4¼d; 1 case pieces, 4s 2d.
Arapolakande	9 do fine dark biscuits, 5s 8d; 1 case fine amber biscuits, 5s 8d; 2 cases fine scrap, 4s 5d.
Glencorse	1 do fine palish to darkish biscuits (pressed and rolled), 5s 7¾d; 1 case rejections, 4s 4½d; 1 case good pressed scrap, 4s 5½d.
Hattangalla	4 do fine pale biscuits, 5s 8d; 1 case fine palish and darkish crepe, 5s 3¼d; 1 case dark pressed crepe 4s 9d; 1 case black pressed crepe, 4s 9d.
Culloden	3 do fine palish to darkish biscuits, 5s 8¼d; 1 case fine pale and dark block, 5s 9d; 1 case good palish to darkish crepe, 5s 1½d; 1 case good darkish crepe, 5s 3¼d; 1 case good dark block and pressed crepe, 4s 8½d; 1 case dark pressed crepe, 4s 8½d.
Ingoya	7 do very fine palish biscuits, 5s 8¼d; 1 case good pressed scrap and cuttings, 4s 5d.
Kumaradola	1 do fine palish biscuits, 5s 8d; 3 cases somewhat similar, 5s 8d; 1 case cuttings, 4s 5½d.
Goonambil	1 do dull biscuits, 5s 8d; 1 bag good rejected biscuits, 5s 2d; 1 box good palish scrap, 4s 4d.

MALAYA.

Highlands Est.	2 do fine washed sheet, 5s 7¾d; 9 cases darker, 5s 7¾d; 6 cases fine palish to darkish crepe, 5s 4d; 12 cases good brownish, 5s 3d; 11 cases good dark, 5s 1¾d; 6 cases good brown, 5s 2d; 5 cases fine washed sheet, 5s 8d; 3 cases darker, 2 cases fine palish ccrepe, 5s 4¾d; 2 cases good darkish crepe, 5s 1¾d; 1 case good dark, 5s 1¾d; 6 cases good brown, 5s 1¾d; 5s 8d.
B.R.R. Co. Ltd.	43 do fine amber sheet, 5s 8d to 5s 8¼d; 6 cases fine palish to darkish crepe, 5s 8d; 3 cases fine palish crepe, 5s 8d; 1 case fine dark block, 5s 9d; 6 cases darker, 5s 9¼d; 2 cases good palish to darkish crepe, 5s 5d; 4 cases palish to darkish, 5s 3¾d; 8 cases good darkish, 5s 1¾d; 5 cases good dark block, 5s 4¼d; 4 cases good dark crepe, 5s 1¾d; 4 cases good brown, 5s 2d.
F (S) R. Co. Ltd.	4 do fine amber sheet, 5s 8d; 3 cases dark mixed block, 5s 2d.
M.	2 do fine amber sheet, 5s 8d to 5s 8¼d; 1 case good wound scrab, 4s 4¾d.

L.E. Muar (in triangle) Straits	11	cases	very fine block, part sold, 5s 11d to 5s 11½d; 1 case very fine pale crepe, 5s 10d; 11 cases fine palish and brownish crepe, 5s 3d.
V.R. Co. Ltd, Klang F.M.S. (in triangle)	7	do	good dark smoked block, 5s 5d; 3 cases brown block, 5s 2½d.
P.S.E.	12	do	fine amber sheet, 5s 8d to 5s 8¼d; 2 cases good dark blocked scrap, 4s 4¼d.
K (in diamond)	1	do	fine palish rolled crepe, 5s 4¾d; 1 case good darkish, 5s 3d.
S (in diamond)	5	do	fine amber sheet, 5s 8d.
Jebong	22	do	very fine pale crepe, 5s 9d; 1 case good dark, 5s 1½d.
C.M.R.E. Ld.	8	do	fine palish to darkish crepe, 5s 8¾d.

GOW, WILSON & STANTON, LTD.

London.

FIBRES.

AGAVE AND FURCRAEA FIBRES FROM MADRAS.

These samples of fibre were forwarded to the Imperial Institute by the Agri-Horticultural Society, Teynampett, Madras. It was stated that the plants had been grown at Madras, Bangalore, and Chickmagalur in the Kadur district, that is, at sea-level, and at 3,000 and 4,000 feet above the sea-level respectively. The samples have been submitted to chemical and mechanical tests in the Scientific and Technical Department of the Imperial Institute, and have been referred to commercial experts for valuation. A description of the fibres and an account of the results of the investigation are given below.

Sample No. 1 (Agave Vera-Cruz).—This sample of Agave Vera-Cruz fibre from Chickmagalur, Kadur, was of a dirty white colour, and had not been well cleaned and prepared, but still retained some adherent green matter. The material was rather weak and irregular in strength, and varied in length from 3 to 4 feet. The results of the chemical examination of this sample are as follows :—

Moisture, per cent.	9·1
Ash, per cent.	2·5
a-Hydrolysis, loss per cent.	19·8
b-Hydrolysis, ,, ,, ,, ...	21·4
Acid purification, loss per cent.	5·7
Mercerisation, ,, ,, ,, ...	12·2
Nitration, gain per cent.	39·1
Cellulose, per cent.	71·4

From a comparison of these results with those obtained with other Indian specimens of Agave fibres which have been examined in the Scientific and Technical Department of the Imperial Institute (see table on page 272), it is evident that the present sample suffers considerable loss when boiled with dilute alkali (*a*- and *b*-hydrolysis). It is probable, however, that this loss is largely due to the extraction by the alkali of gummy matter which was not removed during the preparation of the material, since the greater part of the loss takes place during the first five minutes' boiling (*a*-hydrolysis), and the additional loss after an hour's boiling is comparatively small. It is probable, that, if well prepared, the fibre would be of a good, durable quality. The proportion of cellulose in the fibre is somewhat low, but this, again, is no doubt due to the presence of the impurities already mentioned.

The commercial experts reported that the fibre was worth about £24 to £25 per ton, but that, if well prepared and thoroughly cleaned, it would probably be worth from £26 to £28 per ton in the London market.

Sample No. 2 (Agave Vera-Cruz).—This sample of Agave Vera-Cruz fibre from Madras had been badly prepared and incompletely cleaned, a good deal of green matter still remaining attached to it.

The material was of brownish colour, of rather poor strength, and had a length of staple varying from 3 feet 9 inches to 4 feet 5 inches.

On chemical examination the following results were obtained :—

Moisture, per cent.	9·1
Ash, per cent.	3·4
a-Hydrolysis, loss per cent.	19·5
b-Hydrolysis ,, ,, ,, ...	21·6
Acid purification, loss per cent.	4·5
Mercerisation, ,, ,, ,, ...	12·7
Nitration, gain per cent.	38·0
Cellulose, per cent.	72·5

These figures show that in chemical behaviour and composition this fibre closely resembles Sample 1, and the same conclusions may be drawn with regard to the quality of the product.

The commercial experts reported that the fibre was of inferior quality, had not been well cleaned, and was worth from £22 to £22 10s. per ton in the London market.

Sample No. 3 (Sisal Hemp).—This sample of Sisal Hemp from Madras consisted of pale straw-coloured lustrous fibre, which had been well cleaned, and was of fairly good but rather irregular strength. The length of staple varied from 3 feet 9 inches to 4 feet 3 inches.

On chemical examination the fibre furnished the following results :—

Moisture, per cent.	9·3
Ash, per cent.	1·5
a-Hydrolysis, loss per cent	13·6
b-Hydrolysis, ,, ,, ,, ...	16·9
Acid purification, loss per cent	2·9
Mercerisation, ,, ,, ,, ...	10·8
Nitration, gain per cent.	33·1
Cellulose, per cent.	75·7

These figures show that the sample is of fairly good quality, although somewhat inferior to a specimen of Sisal Hemp from Saharanpur, which has also been examined in the Scientific and Technical Department of the Imperial Institute (see table on page 272). This inferiority is shown particularly in the greater loss sustained in hydrolysis and in the lower percentage of cellulose, and is probably mainly due to the present sample not having been so well cleaned as that from Saharanpur.

The commercial experts reported that the fibre was fairly well cleaned, of medium length and fair colour, and worth from £29 to £30 per ton in the London market.

Sample No. 4 (Sisal Hemp).—This sample of Sisal Hemp from Lal Bagh Bangalore, resembled sample No. 3, but was somewhat cleaner and rather coarser The material was of good strength and had a length of staple 4½ to 5 feet.

The following are the results of the chemical examination of this sample :—

Moisture, per cent.	9·3
Ash, ,, ,, ...	1·2
a-Hydrolysis, loss per cent.	11·4
b-Hydrolysis ,, ,, ,, ...	16·0
Acid purification loss per cent	2·1
Mercerisation, ,, ,, ,, ...	8·4
Nitration, gain per cent.	41·2
Cellulose, per cent.	77·6

These results show that this fibre resembles the preceding sample of Sisal Hemp, but is somewhat superior to it. especially in richness in cellulose. It is however, inferior to the sample from Sahranpur referred to above.

The commercial experts reported that the fibre was of good quality length and colour, and had been fairly well cleaned, but contained some hard, imperfectly prepared strands, and that it was worth £31 to £32 per ton in the London market.

Sample No. 5. (Agave Wightii).—This sample of the fibre of Agave Wightii from Madras consisted of lustrous, pale straw-coloured fibre which had been fairly well cleaned, but still retained a small quantity of adherent green matter. The material was of rather poor strength and had a staple 2 to $2\frac{1}{2}$ feet long.

On chemical examination it yielded the following results :—

Moisture, per cent.	9·9
Ash, per cent.	2·6
a-Hydrolysis, loss per cent.	16·3
b-Hydrolysis, „ „ „	18·7
Acid purification, loss per cent.	2·9
Mercerisation, „ „ „	10·9
Nitration, gain per cent.	14·2
Cellulose, per cent.	75·2

These figures show that the fibre is of fair quality, but rather susceptible to the action of alkali. The greater part of the loss in weight on hydrolysis is sustained, however, during the first five minutes' boiling (*a*-hydrolysis), and appears to be due rather to the presence of gummy impurities which were not removed during the preparation of the material, than to attack of the actual fibre substance. There can be no doubt that this product would be of good serviceable quality if more care were exercised in its preparation.

The commercial experts reported that the fibre was soft, of fair colour and fairly clean, but contained some coarse ends and hard, imperfectly prepared strands. The value of the material was estimated at £22 to £23 per ton in the London market.

Sample No. 6, Mauritius Hemp (*Furcraea gigantea*).—This sample of Mauritius hemp from Lal Bagh, Bangalore, was of a pale greenish-brown colour, and had been very imperfectly prepared. The product was fairly strong, and from 3 feet 6 inches to 4 feet 3 inches in length.

The results of the chemical examination are as follows :-

Moisture, per cent.	9·3
Ash, per cent.	2·1
a-Hydrolysis, loss per cent.	17·1
b-Hydrolysis „ „ „	23·9
Acid purification, loss per cent.	6·1
Mercerisation, „ „ „	12·0
Nitration, gain per cent.	28·0
Cellulose, per cent.	70·3

On comparing these results with those furnished by another Indian sample of *Furcraea gigantea* examined in the Scientific and Technical Department of the Imperial Institute (see table on page 272), it is apparent that the quality of the present sample is decidedly inferior. This is indicated by the greater losses sustained on hydrolysis and mercerisation, the smaller proportion of cellulose and the smaller increase of weight on nitration, and it is therefore probable that this sample would be less valuable and durable.

The commercial experts reported that the sample consisted of rather short and coarse fibre, which was of a poor, dull colour, had not been well cleaned, and was worth £23 to £24 per ton in the London market.

The results obtained in the chemical investigation of these six samples are collected together in the following table, to which are added, for convenience of

comparison, the corresponding values given by other specimens of Indian Agave and Furcraea fibres previously examined in the Department:—

	Samples from the Agri-Horticultural Show.						Samples previously received.		
	Agave Vera Cruz from Chickmagular.	Agave Vera Cruz from Madras.	Sisal Hemp from Madras.	Sisal Hemp from Bangalore.	Agave Wightii from Madras.	Mauritius Hemp from Bangalore.	Agave species rom India (No. 16,260).	Sisal Hemp from India (No. 8,327).	Furcraea Gigantea from India
Moisture, per cent. ...	9·1	9·1	9·3	9·3	9·9	9·3	9·7	9·1	9·8
Ash, per cent. ...	2·5	3·4	1·5	1·2	2·6	2·1	1·5	0·8	—
a-Hydrolysis, loss per cent....	19·8	19·5	13·6	11·4	16·3	17 1	9·8	8·6	12·3
b-Hydrolysis, loss per cent....	21·4	21·6	16·9	16·0	18·7	23·9	15·7	15·1	14·5
Acid purification loss per cent....	5·7	4·5	2·9	2·1	2·9	6·1	2·4	1·6	1·7
Mercerisation, loss per cent....	12·2	12·7	10·8	8·4	10·9	12·0	7·1	12·3	11·4
Nitration, gain per cent. ...	39·1	38·0	33·1	41·2	14·2	28·0	34·0	37·5	40·6
Cellulose, per cent. ...	71·4	72·5	75·7	77·6	75·2	70·3	79·6	81·4	77·7

Experiments have been made with the object of ascertaining the comparative strength of these fibres. For this purpose the breaking strain of single fibres (or filaments) of the material was determined, a large number of tests being made with each sample of fibre. A great variation was found in the strength of the individual fibres (or filaments) of any particular sample corresponding more or less with the variation in their diameter. On taking the average of the results in each case, the comparative strength of the samples was found to be as follows, the greatest strength observed, viz., that of sample No. 4 being represented as 100:—

Sample.		Comparative Strength.
No. 4.	Sisal Hemp	100
No. 3.	,, ,, ...	87·5
No. 6.	Mauritius hemp	81·0
No. 2.	Agave Vera-Cruz fibre	62·7
No. 5.	,, Wightii fibre	57·9
No. 1.	,, Vera-Cruz fibre	55·3

CONCLUSIONS.

The results of this investigation show that the fibres, although of fair, marketable quality, could be considerably improved by the exercise of greater care in their preparation.

It was, unfortunately, impossible to ascertain the influence of the elevation at which the plants were grown on the strength and quality of the fibre produced, since the variation in the degree to which the samples had been cleaned was so considerable as to obscure the inherent quality of the actual fibre substance. In this connection it is interesting to notice that the commercial experts stated that the comparative market values of the various fibres of this class are very uncertain, as most of them are very imperfectly cleaned, and that consequently the value is influenced to an unusual extent by the condition of the fibre.—*Bulletin of the Imperial Institute*, IV, No. 1.

RHEA OR RAMIE IN TIRHUT.

(*Boehmeria nivea*, Hook. & Arn.)

In the Agricultural Ledger, 1898, No. 15, pp. 37—46, Sir G. Watt, in dealing with the cultivation of Rhea or Ramie in Bengal, indicated the extent to which it was then actually grown in that province. He remarked particularly the suitability of the plant to the north-eastern districts of Rungpur, Jalpaiguri and the Duars, and indicated the possibility of an extension of its cultivation westward to Tirhut, though at the same time he pointed out that how far this extension was really possible was for the future to show.

Considerable interest, therefore, attaches to the experience of an association formed in Calcutta in 1900 for the purpose of putting on the market Ramie fibre in a commercial form. This association, the Bengal Rhea Syndicate, entered into an agreement with various planters in the district of Durbungah, in Tirhut, under which the growers were to put a definite area under Ramie, and provide Rhea stalks, the syndicate supplying the necessary machines to produce from these the commercial fibre. It has long been known that there is no serious difficulty attending the cultivation of Ramie, provided the soil is suitable and the climatic conditions are at all favourable. As has already been pointed out (Kew Bulletin, 1888, p. 293), the chief difficulty is as regards the decortication of the Ramie stalks. The experience in Tirhut is therefore of further interest as throwing light on such practical advances as may have been made in this direction.

That the plant could be successfully grown in Tirhut on an experimental scale was already known; various planters in Tirhut had demonstrated this in plots containing plants raised from roots supplied from the Royal Botanic Garden at Calcutta, and to a smaller extent from the Botanic Garden at Saharanpur. But what Sir G. Watt had in view, and what it was desirable to test was whether, if the difficulties attending decortication were overcome, the cultivation of the plant in Tirhut was likely to prove remunerative commercially. The original contracts entered into by the syndicate in question were nine in number; the area involved amounted to 3,700 acres. Actually, however, owing to difficulties connected with soil and rainfall, operations had to be restricted to seven concerns with an aggregate area of 3,100 acres, and of the suitable available land the amount actually under Ramie in February, 1906, was 1,950 acres. The results of these operations, which have now extended over several years, are calculated to throw some light on both questions.

These results have been made generally available by the publication in the "Journal d'Agriculture Tropicale" for June 30th, 1906, of the French test of an account of the operations, which is there stated to have been supplied on February 10, 1906, to the Director of Agriculture, Bengal, by Mr. J. Karpelés the managing director of the Bengal Rhea Syndicate. The original agreement entered into by the syndicate with the planters in Durbungah stipulated that the growers were to produce the Ramie stalks, while the syndicate were to supply the machines for preparing the commercial fibre. The fact that the firm in Calcutta to which the Syndicate's managing director belongs acted as agents in India for the machine especially devised by Mr. Faure for dealing with Ramie, adds further to the interest of the account.

In the "Queensland Agricultural Journal" for November, 1906, (p. 247,) is given a translation of the report referred to, which is here reprinted. Its value is considerable owing to the fairness with which the results obtained and the difficulties encountered by the Bengal Rhea Syndicate have been stated. But, as pointed out in the 'Queensland Agricultural Journal,' it possesses another interest—it gives for the first time, so far at least as India is concerned, an account of operations on a scale sufficiently extensive to justify the formation of reliable estimates for a plantation:—

"At the outset there was considerable difficulty in procuring the necessary quantity of plants to establish the plantations. Some small lots of stocks (rooted plants) were certainly obtained from various localities, notably from Assam, and from sundry Indian botanical gardens, but these supplies were insufficient in quantity, and often of bad quality; it therefore became necessary to establish on each farm a nursery for the multiplication of rhizomes.

"The plantations suffered much from the attacks of white ants, which rapidly destroyed the young roots, and especially the cuttings. The planting of cuttings, however, during the rainy season obviated to some extent this inconvenience, but still the best method of reproduction is the division of the rooted plants. Portions of the rhizomes may be taken from one to two-year-old plants without injuring them.

"It was evident from the commencement that successful plantations could only be established on light, porous soils; saltpetre and alkali soils are not conducive to the production of Ramie. On well-cultivated lands, where noxious weeds had been carefully eradicated, every root produced annually 15 to 30 stalks, about 5 feet in length, whilst in a field left as an experiment without cultivation produced only from two to five stems per plant; the plot in the same field, called the 'control plot,' which had been weeded and cleaned, gave 10 to 15 stems. It will thus be seen that a Ramie field must be well cultivated, in spite of the increased expense, the field having to be cleaned by hand labour to avoid damage to the roots and young shoots.

"In the three-year-old well-cultivated fields, no sign of soil exhaustion has yet been observed, although the upper part of the root has a tendency to become woody, to the detriment of the development of new stems. To overcome this, it is intended to remove the lignified portion every year, in order to rejuvenate the plants. Experience alone will decide if this is a good idea.

"Ramie is a very exhaustive crop, and, therefore, the question of manure must be carefully studied, for unmanured plants yield a very poor crop. Good results were obtained by the use of indigo refuse. It is said that the refuse of Ramie itself, such as the leaves, bark, and wood, constitutes a perfect manure, sufficient to restore to the soil the constituents taken out of it by the crop, But, up to the present, no experiments in this direction have been possible, as no where has the decortication of the stems been carried on in a systematic manner. However, at Dalsing Serai, a manure consisting of decomposed Ramie refuse was applied to the experimental plots with excellent results. It has not yet been determined what quantity of such manure is needed. At Dalsing Serai and Mooktapore, where respectively 60 and 40 acres are in full bearing, there is a sufficiency of fermented material which will be utilised for manure. The leaves, separated from the stems when the latter are cut, are left on the ground, and these form a good mulch for the roots, at the same time supplying a manure.

"Ramie requires a good deal of moisture to properly develop, but water must not be allowed to remain too long on the ground, as the rotting of the roots would probably be thus caused. This was the unfortunate experience on plantations established on the low, flat country, where, last September (1905), many hundreds of acres were destroyed in consequence of the heavy rains. Ramie requires at least 45 inches of rain per annum. Two plantations had to be abandoned in a district where the annual rainfall did not exceed 35 inches. Consequently, cultivation was only carried on on seven plantations, representing an aggregate area of 3,100 acres, of which 1,950 acres were planted up to February, 1906. The remaining 1,150 acres will, we are told, be planted during the next rainy season.

"It is very important to cut the stems at the proper time. If they are cut too soon, they yield a very fine fibre, but in small quantity ; if cut too late, the decortication becomes more difficult, and the fibre is brittle. The best time to cut

is when the base of the stem is of a brownish tint for a height of about 10 inches. The stems must be worked up immediately they are cut. The decortication is much more readily performed if carried out within 12 hours of the cutting. When they have been allowed to dry decortication is more difficult, and the fibre is inferior. If circumstances render it necessary to defer decortication, the stems, having the leaves removed, are made into little bundles of thirty or forty, and preserved in water, where they will remain unchanged for forty-eight hours.

"Fibre containing 30 per cent. of gum does not easily dry in the climate of Bengal. The syndicate has, therefore, been obliged to have special drying apparatus constructed in Paris, and installed on each plantation. The fibre on leaving the decorticating machine passes first through a centrifugal drier, made by Dehaitre, which removes 70 per cent. of the water it holds. It is then hung up in a large closed-in straining-room, supplied with a current of warm air set in motion by a fan.

"The fibre, when ready, must be at once baled, for it readily absorbs a quantity of fresh moisture from the air, which would soon produce fermentation and mouldiness. At Dalsing Serai a hand press is used.

"A 20-h.p. engine is sufficient to drive all the machines required for 500 acres. As the fibre has to be washed as it passes through the decorticators, a good and sufficient water supply is indispensable.

"The fibre must not be twisted, as this imparts to it a permanent undulation which depreciates it from the spinner's point of view.

"Many samples of Ramie fibre produced by the syndicate were sent to Europe to several spinners. They were considered quite equal in quality to China grass, and very shortly orders were received totalling 1,500 tons. Some 20 tons of better quality fibre, more carefully prepared than hitherto, have been lately exported from the syndicate's estates.

"From a forecast of the next year's crop (1906) the syndicate should be in a position to deliver at least 200 tons of fibre from the 1,950 acres already under cultivation. This is said to be a very moderate estimate, since the normal production from this area will be, it is estimated, 800 tons when in full maturity.

"It is the intention of the syndicate, in the near future, to de-gum the fibre as well as decorticate the stems, in order to save the freight charges on 30 per cent. of gummy substance contained in it. But, as every spinner of Ramie has his own particular method of de-gumming, all of them require the fibre to be delivered to them without its having been subjected to any chemical treatment. It is hoped, however, that flax spinners will some day take up Ramie as well, and will accept the fibre de-gummed on the plantation."

In connection with this account of the operations of the Bengal Rhea Syndicate, the "Queensland Agricultural Journal" publishes certain critical remarks on the prospects of successful cultivation of Ramie in Queensland. But Queensland is not the only Colony where there are considerable areas with climatic conditions approximating to those that are known to prevail in Tirhut, and the questions raised in the Journal deserve consideration by those who contemplate the extensive cultivation of Ramie elsewhere. These remarks are therefore reproduced below.

"From the above account of the operations of the Bengal syndicate, we can form some idea of the initial difficulties to be encountered in entering upon Ramie cultivation. After six years' work the company has 1,950 acres under cultivation, from which they have obtained 20 tons of fibre, and, posssibly, 200 tons will be the result of the 1906 crop. Two hundred and twenty tons is not a large return from such an area. The expenditure on over 3,000. acres must have been very considerable during six years. With cheap and abundant and reliable labour, the necessary humid

climate, and abundant water supply, and cheap water carriage, one would have expected far greater results. Ribbons are worth £14 per ton in the English market. Clean de-gummed fibre is worth £50 per ton. Clean undegummed fibre from the plantation is worth about £24 per ton in London. At this latter price, 220 tons would be worth £5,280, or a return of £880 per annum spread over the six years since commencement. Decorticating machines, motive power, expenses of management, labour, freights, &c. have all to be deducted.

"Mr. J. Macdonald (of Macdonald, Boyle & Co., London) estimated the cost of 900 acres of Ramie under cultivation from planting to extraction of the fibre at £6,477 17s., and the machinery at £6,775.

"At the end of the first year the product might be estimated at 450 tons of clean fibre, ready for the manufacturer. This, at 4½d. per lb., amounts to £18,900. Deducting the cost of production as above, also £900 for freight, and £260 for brokerage and incidentals, a working profit remains of £11,262 3s.

"This estimate, so extremely sanguine, was based on a three and a half to four years old Ramie plantation. Yet Mr. Macdonald begins operations six months after planting! An obvious discrepancy. Practical men would be better pleased to see a well-considered moderate statement work out a possible profit of £5 per acre than to be met with £12 profit per acre the first year, and well nigh £50 in the second, from a cultivation which, so far as we know, no one has yet tried, except the Bengal syndicate above described, on a scale sufficiently large to justify reliable estimates for a plantation, at any rate in the Eastern world.

Queensland planters would not be likely to drop sugar, cotton, pineapples, &c., for a return of £880 per annum from 1,950 acres, and from which return heavy expenses have to be deducted."—*Kew Bulletin*, No 1, 1907.

EDIBLE PRODUCTS.

Fruit Cultivation in Ceylon.

By J. C. WILLIS.

In this paper I only propose to suggest a few points that have occurred to me in considering this subject. One of the first things that a new-comer complains of is the lack of good and cheap fruit. Plantains and Papaws form the staple of the fruit, and only rarely can really good fruit be got, and not only so, but when it is to be had it is very expensive. Mangosteens in Ceylon cost about five times what they cost in Java, and I was told by a landowner that he had rented out his mangosteen trees at Rs. 100 each a year. If all the fruit were exported there would be less reason to complain, but there is no export either.

Ceylon *can* produce good oranges, plantains, limes, mangoes, mangosteens, durians, breadfruits, jaks, cherimoyers, pineapples, papaws, avocado pears, sapodillas, cashewnuts, passion fruits, tree tomatos, &c., and in Java, the West Indies, Calcutta, and elsewhere in the tropics one can get good and plentiful fruit. Why do we not get it here ?

People, especially if they have children, say they will give a good price for good fruit, and the grower says he will sell good fruit for a good price. The great difficulty seems to be to bring them together. One method, and a good one if it could be properly put through, would be a co-operative fruit supply society. Let a number of people subscribe each so much a year, and pay a reliable man to grow fruit in three or four places—say near Colombo, in Hewaheta, and Udapussellawa—and let the shareholders take the fruit according to their shares. One great difficulty in the way is of course the migrating nature of the European population, who would be the principal consumers of the fruit.

Another possibility is a "Fruit Supply Agency." Let those willing to buy good fruit send in their names, and all those willing to sell also. Let the agency be worked by a capable inspector, who shall fix prices with sellers, and let him then calculate at what prices fruit can be laid down at the nearest railway station to purchasers. Let him then send a list of fruits and prices to the latter and get orders from them and give them out. Of course his own salary etc., would have to be included in the cost.

This method would surely work better than the present haphazard system, where one has first to find out where the fruit is grown, and then write to A for oranges, B for mangosteens, and so on. An agency of this kind might very well be established by the Agricultural Society.

Now let us consider the question of export. People always think of Europe when they talk of exporting produce, but there are other places to which it may be sent. To Europe one requires cold storage for fruits, at least for most kinds. The steamers fitted with cold storage will only carry fruit if one will guarantee to fill the boat every time she calls at Colombo (unless one could arrange with say the Queensland or Straits Governments to fill a share of a boat). This means the sinking of a large amount of capital in what at first must be a speculation, and of course we should have to compete with the West Indies and other places which have shorter distances to send, no canal dues to pay, and familiarity with the industry.

But why should we not export to other countries, *e.g.*, India, or even more Australia, which are near to us and where we have no canal dues. To India there seems but little hope of exporting fruit to pay. The Calcutta market is already

well supplied and its prices are lower than those in Colombo. In South India it seems possible that there would be a market for mangosteens, durians and avocado pears.

But to Australia, at any rate as far as Melbourne, fruit can be shipped at least during a large part of the year, without cold storage. The three great steamship companies running to Australia quote rates of from Rs. 25 to Rs. 50 per ton of 50 cubic feet at shipper's risk.

This is a high but not a prohibitive rate. It would, for instance, add perhaps 5 cents to the cost of a plantain, so that one would have to be sold for a penny, not an excessive rate by any means. The taste for plantains is one that continually grows on the people of the colder zones, and a big trade might perhaps be built up by degrees. The competition to be met would be that of Queensland, but Ceylon with cheaper labour should be able to compete with good chances of success, at least as far as Adelaide.

These matters are well worthy of careful consideration and perhaps action by Agricultural Societies.

Coconut Cultivation in the Southern Province.

By H. Amarasuriya.

1. Growth on Different Soils Compared.

The soils in which the Coconut thrives best are the flat soils along the sea coast where the Coconut palm finds sufficient natural supplies of salt and lime. It has been noticed that on such favoured soils a mature full-grown tree yields as many as 100 nuts on an average without any particular attention being paid to it.

Next in importance to the soils on the sea-coast are those on either side of the rivers which overflow their banks periodically during the rainy weather. Coconut trees growing on these river banks also give a considerable yield, but slightly less than those along the sea-coast. However, the farther inland the Coconut is grown the less suitable is the land for its cultivation. Plantations on such lands require a large amount of care and systematic cultivation, except those planted within a radius of 20 or 30 fathoms from the boutiques and huts of villages.

These plantations though of comparatively small acreage thrive invariably well. The reason for this exceptional growth is the care which is unconscioulу bestowed on these trees by the occupants of the respective houses; for all refuse, dirt, and sweepings which are carelessly huddled round the trees contain valuable plantfood eagerly absorbed by the Coconut palms.

2. The Mode of Planting and Cultivation Required for Soils in the Interior.

Further inland the soils are not flat but undulating and hilly, with shrubby jungle growth. As only such lands are at present available for further extension in the Southern Province, I would suggest the following for opening and planting new fields:—

The jungle should be felled in December and burnt during the first week in the following February. All the burnt matter having been removed, the necessary roads should be cut. It should be borne in mind that these roads are to serve for transport at a subsequent stage, when the estate comes into bearing.

Drains should be cut at a gradient of one foot in twenty feet, to prevent the rich surface soil from washing down. The Coconut holes are then to be cut to the size of 3 ft. × 3 ft., being 24 feet apart from each other along square lines, giving 75 to the acre. Before the planting season begins in May the holes should be filled one foot deep with sea-sand, about three basketsful to every hole.

It has been found that sea-sand preserves the young plants from the attacks of white ants and the ravages resulting from dry weather, which immediately follows the planting season. It also helps the young plant to throw out its roots quickly. When the land is fully planted clean weeding should be started and continued monthly for a period of three years. In order to defray a portion of the expenses of weeding, sweet potatoes might be grown.

The plantation during this period should be carefully protected against the attacks of cattle. Three years later, clean weeding might be dispensed with; weeding round the plant only should however be continued for another three years. Rooting out jungle growth on the rest of the land ought to be done twice a year: grass however may be left to grow.

At this stage the Black Beetle must be carefully warded off. The trees will then begin to form their trunks, and porcupines will appear as another danger. These are dangers which are familiar to everyone who knows something about Coconut planting, and therefore I need not go further into the mode of their prevention. Assuming that the plantation has eventually attained an age of 10 years, it will be found to have a good percentage of trees in blossom. I may here mention that there are some who believe that a Coconut tree blossoms and begins to bear when it reaches its seventh year. This theory is wrong as a general rule, and it must be borne in mind that such rapid growth is confined only to those trees which are growing on the sea-coast.

3. The Manuring of the Coconut Palm.

The most important question which requires the earnest consideration of the planter when his estate has partly reached the blossoming stage is the mode of manuring his estate, whereby the trees can be made to yield remuneratively without forcing the crops. This work is a very delicate one indeed, and should be taken in hand very cautiously.

Manuring at this stage should not be done indiscriminately. Those trees which are in a vigorous and healthy state, and those with a good development of leaf must be singled out and left alone; whilst others, which show poor growth, and are on indifferent soil, should be marked out for treatment with the application of the following manure mixture of Messrs. Freudenberg & Co. :—

4	lbs.	Specially Selected Castor Cake
2	,,	Steamed Bones (Freudenberg's manufacture)
2	,,	Bone Meal
3	,,	Kainit
1	,,	Muriate of Potash
12	lbs.	

Cost delivered in Colombo at railway station or into boat

per acre about Rs. 32·14

per ton gross weight Rs. 80·00.

The above mixture, with 24 lbs. of cattle manure added to it, should be applied to every poor tree, so that there would be a total of 36 lbs. of manuring substance. This application would cost 75 cents per tree; but it cannot be estimated how much it would cost per acre, as it is impossible to say here how many trees will be found to need it. When by this treatment the trees are brought to a uniform degree of growth, application of manure, either cattle dung, if procurable, or artificial manure, might be undertaken all round once in two years.

Provided all trees are beyond the reach of cattle, I would suggest another very commendable mode of manuring. Buffaloes or cattle might be tied during the night, one to each tree. The urine and other excrements from these animals contain splendid tree fertilizing properties, and the constant trampling round the tree loosens the soil and makes it porous, thus helping the roots to assimilate the manure quicker.

One animal should be tied to a tree for ten days in succession, and then another tree should be treated similarly. To carry out this system of manuring successfully, 100 head of cattle will be required for a plantation of 100 acres, and it will take two years to give a complete manuring to the whole acreage. If sufficient fodder and grass can be procured easily for a herd of 100 head of cattle, I consider it very advantageous to resort to this mode of manuring.

Green manures, such as "Keppitiya" and Kaduru, if available in large quantities, are also good for application to the Coconut tree. A bundle of 40 lbs. of either of these mixed with burnt coconut husk should be buried round the tree five to six feet from the trunk and 6" deep.

4. Number of Trees and their Yield Per Acre.

There are some who recommend planting 30 ft. by 30 ft. as a good distance for coconuts. On exceptionally rich soils this distance is, I believe, a very suitable one; but on hilly lands planting 24 feet apart is better. An acre planted 24 ft. × 24 ft. will contain 75 trees, and if properly looked after, and cultivated in the manner described above, will safely yield on an average 30 nuts per tree annually harvested in six crops. The best crops of the year are secured during the months of May and July. There are of course rare instances where Coconut trees are found to yield from 100 to 150 nuts each. Such abnormal yields are however confined to exceptional soils and conditions.

A good many nuts are lost on estates during the dry weather of the months of December, January, February, and March, on account of the young nuts falling off, owing to the tender stems of the undeveloped bunches breaking. This loss can be prevented by applying "supports" to them before the dry weather sets in during the month of December, continuing the operation during January, February, and March, when the year's crop has fairly developed into the nut stage.

5. Results from Manuring Experiments.

I shall now lay down some results obtained from experiments, made on a very small scale, in an altogether hilly plot, on Citrus Group Estate, Galle, containing about 1,200 trees. Cattle manure in small quantities was applied to a number of trees which showed indifferent growth in 1901, and again portions were manured with Freudenberg & Co.'s artificial manure No. 5 in 1903. A table is appended comparing the crops harvested during a period of five successive years. Had not the severe drought experienced during the first quarter of 1905 caused the falling off of a considerable number of young nuts, a crop of 40,000 nuts could have been easily plucked during that year.

		1902.	1903.	1904.	1905.	1906.
1. February Crop	...	1,112	3,626	2,008	2,469	2,320
2. April ,,	...	1,181	5,517	3,490	4,112	4,668
3. June ,,	...	2,257	6,784	5,700	8,356	6,985
4. August ,,	...	4,140	6,999	6,473	8,759	9,6
5. October ,,	...	2,340	3,245	4,247	7,036	5,253
6. December ,,	...	1,330	2,418	2,175	2,654	2,970
	...	12,360	28,589	24,093	33,386	31,814

Experiments in Manuring Dumbara (Ceylon) Tobacco.

By Mr. C. Rasanayagam.

The cultivation of tobacco, which was introduced into Dumbara in 1868, has for the last 20 years become a settled industry among the native inhabitants. Large quantities of tobacco are annually taken to Jaffna which is the only market available at present for the Dumbara leaf. With the increase of cultivation the supply has exceeded the requirements of a limited market, and the price has, as a necessary consequence, fallen. The tobacco of the first quality which ten years ago fetched prices ranging from Rs. 15 to Rs. 20 per 1,000 leaves is now being sold at the rate of Rs. 6 to Rs. 8. The cultivator, with the desire of producing the best leaf—of the Jaffna standard—with the least possible outlay, has therefore been forced to resort to the selection of jungle lands for his cultivation, on account of the natural fertility of the soil. The cost of manuring adopted by the cultivator in the northern and maritime districts, where the price of tobacco is much higher, is found too prohibitive by his Dumbara brother. The jungle lands suitable for the cultivation of tobacco in the Dumbara valley being almost exhausted, the cultivator is driven back to those lands which have become impoverished by repeated cropping. The Dumbara cultivator who has ever since the introduction of the industry been the favoured child of nature, has now been brought face to face with the difficult problem of manuring and producing tobacco of the required quality with the least possible outlay. Some enterprising cultivators have for the last few years been trying to solve the problem by the use of cattle manure on their lands.

The mode of manuring adopted by them is not by burying the manure round or near the plants as is in vogue in cases of other plantations, but by tethering cattle on the land for a few months prior to the tilling of the soil. Manuring, according to this method, costs little or nothing, as a number of cattle can be had from the villagers for the mere asking, and pasture lands being often available near the land proposed to be cultivated, one boy is sufficient to tend them during the months they are required. The system is only practicable if it can be confined to a few cultivators, but when adopted by all it would become expensive and troublesome.

The cultivators are also not satisfied with cattle manure as certain diseases are, either rightly or wrongly, attributed to it. During the season of 1905 I had cattle manure under my observation, and I found that although it did assist in the growth of the plant, yet the pests and diseases common to exhausted soils were also present. Hence, from a desire to experiment with scientific manure which contains only such ingredients as are necessary for the tobacco plant and to note the relative merits of cattle and artificial manures, I applied to Messrs. Freudenberg & Co. for a composition containing phosphoric acid, nitrogen and potash in the proportion of 4, 5 and 8, a composition I had found mentioned as being suitable for tobacco in a booklet on manures supplied by the same firm. They gave me the following composition :—

160	lbs.	best white Castor cake
40	,,	Nitrate of Potash
40	,,	,, Soda
10	,,	Freudenberg & Co.'s Patent Manure, No. 1
60	,,	Superphosphate
60	,,	Slaked Lime

making an aggregate of 400 lbs. said to be sufficient for half an acre. I intended to purchase the manure necessary for 3 acres, but had to give up the idea as the outlay of about Rs. 100 was prohibitive as an experimental venture. The manure

could not have possibly been tried on a lesser extent, as it would have been impossible to separately cure the tobacco so grown. Ultimately, however, at the instance of the Secretary, Ceylon Agricultural Society, Messrs. Freudenberg & Co. consented to supply me with a quantity sufficient for half an acre free of cost, on condition that another half an acre was left unmanured, the results compared, and a report made to the Society on the experiment. I, however, took the opportunity of comparing the merits of cattle manure as well, and this paper embodies the result of the experiment.

While negotiations for the manure were going on, I persuaded a tobacco cultivator, who had manured his land according to the system previously referred to, namely, tethering cattle, to turn up the soil of another acre adjoining his land, so that we had three plots contiguous to each other, and each about half an acre in extent, prepared for the purposes of the experiment; on one of which cattle manure was used, the other was left unmanured, and the third was reserved for artificial manure. Although the transplanting from the nursery, which in other years used to take place in April, was delayed till the 15th of May in 1906 on account of the unprecedented drought, the manure from Messrs. Freudenberg & Co. did not arrive till the plants had been set in. I received the manure on the 19th June, by which time the plants had already taken root but the manure could not have been applied at once, as the ground was hard from want of rain, and as I did not wish to disturb the soil round the plants at the time. In the meantime the plants on the portion manured with cattle manure had outgrown the plants on the other two plots, although the effect of the drought was clearly visible on them all. On the 5th July, however, there was a shower of rain sufficient to soak through the soil some inches, and on the 6th July the manure was applied by sprinkling about 2 ounces of it round each plant an inch away from the root, and mixing it with the soil and covering it up with fresh soil. The manure was applied in this way to about 3,000 plants covering an extent of exactly half an acre. The effect in a few days was magical as the plants helped by a shower of rain soon afterwards began to grow steadily, and by the first week of August they were of the same height as those on the portion manured with cattle manure. But, unfortunately, about the third week of July, most of the plants on this plot as well as on the manured portion were attacked by the stem borer and although immediate steps were taken to eradicate the pest, a large number of plants either died or became quite useless. The man on whose plantation the experiment was tried was quite against the total destruction of the plants attacked and adopted a new measure to fight against the pest. He cut the plants across just below the point attacked by the stem borer, and allowed a fresh shoot or sucker to grow from the stump which, though not half as vigorous as the mother plant, would have been found to be of some value. The stem borer did not, however, attack the portion fertilized with cattle manure, and I attribute it not to the superiority of the cattle manure, but to the difference of height and growth of the plants, as the plants on the cattle manured portion had outgrown the height at which the pest usually manifests itself. The effect of the pest was such that the plantation was shorter by about 2,000 plants.

Just before the plants were topped and some time after while the leaves were maturing, there was sufficient opportunity to compare the height and girth of the plants, the length and size of the leaves, and the average number of leaves to a plant on the different plots. While the plants on the two manured plots were almost of the same height and girth and the leaves broader and longer, the plants on the unmanured plot were much shorter and thinner and the leaves much smaller. In short, the superiority of the plants on the manured plots over those on the unmanured was so apparent that no minute comparison was at

all necessary. The plants on the unmanured portion were so unhealthy and stunted that they seemed not deserving of the weeding and care paid to them. The best plant on the unmanured did not compare favourably with the worst in the other two plots. There was, also, ample opportunity to compare the results of the two different kinds of manure applied. The only difference in the two manured plots was that, while the growth and size of the plants in the plot fertilized with artificial manure were uniform throughout, there was not much uniformity in the other plot on which patches of high and vigorous plants were interspersed with those of inferior growth and size. This was perhaps accounted for by a corresponding want of uniformity in the distribution of cattle manure. Although the plot fertilized with cattle manure enjoyed immunity from the ravages of the stem borer, there were quite a number of plants attacked with diseases called "Kara" (white leaves), "Suruttal" (curled leaves), and "Paluppu" (sudden and premature ripening), as compared with those on the other plot. "Kara," which is a disease quite common on impoverished soils, prevents the full development of the leaf. It is the presence of these diseases which makes the cultivator have no special reliance on cattle manure.

THE CROP IN THE SEVERAL PLOTS

was as follows :—

	No. of plants.	No. of leaves.	Average.
Artificial manure ...	2,100	25,000	11·90
Cattle manure ...	2,800	32,700	11·68
Unmanured ...	1,900	16,000	8·74

It is much to be regretted that on account of the paucity of leaves, they could not have been separately cured, and therefore the difference in their market value and the proportion of leaves which go to form the different grades—a material point—could not have been separately ascertained. An attempt was made to discriminate the leaves of the different plots, by means of certain marks, but on account of the great trouble, patience and intelligent labour involved, the attempt had to be abandoned.

The experiment has been instructive in more points than one. From the nature and size of the plants on the unmatured portion, it was manifest that the growth of plants was tardy or wholly arrested for want of sufficient food constituents in the soil; from the rapid growth of plants on the plots fertilized with cattle manure that fertilizing agents should be well incorporated into the soil before transplanting; from erratic growth in one plot and the uniform growth in the other that artificial manure was preferable to the system of tethering cattle to ensure uniformity of growth which is advantageous in that it facilitates and simplifies the gathering of the crop; and that cattle manure is for the present cheaper although it may contain constituents detrimental to the health of the plants.

Green manure, which is extensively used in the North, has not been experimented upon in Dumbara, although the Sinhalese have been in the habit of using "Keppitia" leaves in betel and "Karanda" and "Kekuna" in paddy cultivation. When the difficulty of procuring cheap manure was brought to the notice of Mr. Kelway Bamber, who was present at a meeting of the Dumbara Agricultural Society in November last, he was kind enough to give some valuable and practical hints as to green manuring. He suggested that "Pila " or Sivanarvembo (Tamil) *Aspalathus indica* may be raised on impoverished soils and the plants buried root, branch and all before they podded. The use this plant could be put to was not previously known to the Dumbara cultivator, and as it grows in wild profusion

within the tobacco-growing area, it is by far the cheapest nitrogenous manure available at present. The fact that this plant grows so largely on lands suitable for tobacco cultivation is perhaps an indication of the nature of the use to which it may be so advantageously put. Acting on the suggestion made by Mr. Bamber, some of the cultivators who hitherto regarded this plant as a noxious growth and burnt it with other shrubs and weeds as waste, have buried them while turning the soil for this year's cultivation. They have, however, failed to see the importance of the suggestion that the plants should be used as green manure before they *blossomed* and *podded.* If "Pila" is at all to be used as green manure, the seed ought to be sown on the land proposed to be cultivated only a few months before January or February, so that the plants may be turned into the soil before they come into bearing. If the difficulty of ascertaining what short of manure, whether potash or nitrogen, is necessary for a certain land, can be surmounted, with the assistance of the Scientific Department at Peradeniya, the cultivators can be taught to grow pila, albizzia or other kinds of green manure to supply the nitrogen and to use wood ashes or some such thing to supply the potash without groping in the dark as to the quality and quantity of manure they should use, and thereby avoid a surfeit of one or a neglect of the other. The superior advantage of the use of scientific manure in the cultivation of tobacco cannot be availed of unless the tobacco grown in Dumbara finds a better market than Jaffna and obtains a better price than it does at present. If not, it is neither encouraging nor profitable to undergo an initial heavy expenditure under head " manure." The Jaffna trader being not discriminating as to the quality of the article he purchases, and the market being glutted with leaves of indifferent curing and quality, the cultivation cannot be carried on with profit. The present system of promiscuous cultivation by which diseases and pests are annually increased is bound to continue until either tobacco cultivation in Dumbara altogether fails, or the cultivator is induced to adopt a more scientific system of cultivation and curing.

[These results are very interesting, but unless some co-operative manure supply were put in hand, the cost of the manure would be beyond the means of the villagers, and quite possibly even then.—ED. *T.A*.]

THE LEADING TEAS OF THE WORLD. CHINA.

BY THE LATE HERBERT COMPTON.

I had intended devoting but a single article to China teas, but I have changed my mind. My acquaintance with the "Flowery Land" is not so immediate as with India and Ceylon, and consequently, in order to do justice to the subject, I made a couple of pilgrimages to the libraries of the British Museum and India Office to look up the subject thoroughly. As luck would have it, I stumbled upon one of the most interesting old books I have ever found in the former gold mine of research, albeit I have spent many hundreds—I think I might veraciously write, thousands—of hours in that Valhalla of written lore and learning. A discovery like this sets me itching to share its delights with others, and, so—although it is outside the four corners of my commission—I purpose to be a little discursive after applying myself to modern commercial facts about China teas.

China teas are manufactured from the variety of the plant known as *Thea bohea*, which is, substantially, the only one found in Cathay. The foliage is of a dark green, often a sage or live green colour, and the size of the leaves varies from 1½ to 3 inches. It is a shrub or a bush rather than a tree, and this is where it differs from the *Thea viridis* of India, which is a large, strong-growing plant, increasing into quite a tree with spreading branches, and whose mature leaves range from 3 to 5 inches in length.

There is no doubt in scientific minds but that the China plant came orginally from the hill countries between China and India proper, from whence, to this day, the finest and purest seed is imported after being gathered by the wild aborigines in the primeval jungles. The "hybrid" plant, which is the product of the China plant fertilized with the pollen of the indigenous variety (or *vice versa*), shows the ease with which the tea-plant can deteriorate, and quite explains the feasibility of the China bush tracing its ancestry back to the indigenous one of Assam, Manipuri and adjacent parts. The question is when did it emigrate? Tradition dates the interesting exodus back to the days of Noah or say 3,000 years and more before Christ. The credit of its discovery and utilisation is ascribed to Shing Ning, the father of Chinese agriculture, who is said to have planted the first tea garden. Confucius referred to tea a couple of thousands of years before Christ, and so recent a luminary as Lo-yu touched on the topic a trifle of 2,686 years ago. I am indebted for these historical particulars to an interesting anonymous brochure, published in 1866, and entitled "Tea and Tea Blending."

Come to more modern times we find it recorded that the poorest lands in China were given up to tea planting, from whence originated the idea, acted on in starting the industry in India, that tea throve best on the sides of precipices! The reason why it was relegated to the hungriest soils was because it is a hardy plant that will grow almost anywhere, and the thrifty Chianman kept his best land for his rice and grain crops. But the better soil you plant tea in the better the result will be.

There are three "pickings" in China. The first crop is gathered in April and May, the second in June and July, and the third in the autumn. The chief centres for the collection and export of the product are Hankow and Shanghai in the north, Foo Choo Foo in the centre, and Canton in the south. The first two supply black leaf Congous and Monings, and from their geographical position are calculated to produce the best quality teas. From Foo Choo Foo come the red leaf Congous and the Kaisows, and from Canton the "new makes" or province leaf Congous.

There are eight classes of Monings, viz.:—

1. *Kintucks*—delicate flavour, choice, strong, reddish infusion.
2. *Keemums*—Much as above; thick, rich liquour and rich aroma.
3. *Kiukangs*—Fragrant and flavoury, but lack body.
4. *Ning Chows*—The backbone of Moning blends.
5. *Kutoaus*—Short rusty leaf, with tip; intense strength, keeps badly; goes "minty" or "herby."
6. *Oonfaas*—Marked tarry or smoky flavour—poor looking; nevertheless much prized by some blenders.
7. *Oopacks*—Grown near Hankow—out of flavour.
8. *Shantums*—Lowest kind of Moning—poor stuff.—*Tea and Coffee Journal.*

TIMBERS.

POSSIBILITIES OF WOOD PRODUCTS III.

Prof. E. Pfuhl has recently published a very interesting book on "Paper Yarn: Its Production, Properties, and Uses." In his book, Prof. Pfuhl gives an account of the progress that has been made in producing yarn from threads prepared by a wet felting of fibres, and the results are most interesting. The raw material, consisting largely of chemical wood pulp, is dealt with in a special manner in the beating engine, so as to reduce the length of the fibres to the necessary extent, and convert the whole into a good felting paper pulp. The pulp is then brought on to a Fourdrinier machine, and a layer of this pulp produced in the ordinary manner, after which it is divided into a number of narrow bands, which bands are twisted by mechanical means, and converted into threads. According to Prof. Pfuhl there are two processes in practical working. One is for the production of a material known as "xyloline" based on the patents of Claviez & Co. In this the strips of pulp, as they come away from the machine, are wound on to reels, and these reels are then fixed to revolving forks, so that on winding the strip off the reel, it receives the necessary twist, and is mechanically treated otherwise. The material produced yields a strong yarn, and is so cheap that a complete suit of clothes can be sold for 7s. to 10s. It is further stated that it can be washed without being damaged in any way. Silvaline is also produced at Golzenn-Grimma on the lines invented by Herr R. Kron. Here paper is divided into strips and subsequently spun into threads, and the machinery is very delicate and beautiful. The first factory was erected in Spain, near Bilbao, and another factory has been erected in Holland. Other factories at Rattimau and Mesterlitz, in Germany, are being erected, and the enterprise is extending to Russia, and there is no doubt that silvaline and xyloline will enter into direct competition with jute, and possibly coarse cotton yarn.

The rapidity of the progress made in this branch of technology is a marvel among modern enterprises, and it is doubtful if, in the history of the nations of the world, any one industry has achieved such a success in comparatively so short a period of time. Probably few realise what an amount of wood pulp the publication of our daily newspapers requires. I may here remark that in London one "daily" has recently entered into a contract for the purchase of 10,000 tons of paper per annum for three years, and I think it would be fair to estimate that each day one of our large London daily papers consumes 10 acres of an average forest. Wood pulp owes its wide range of application to the fact that it is a material that can be made to any degree of consistency, from a delicate almost intangible fabric to a dense mass as hard as metal. It can be dyed to any colour or shade; it can be rendered fire and waterproof; and in the hands of the chemist may be converted into a number of very useful combinations.

Ekman, it is not generally known, succeeded in producing a substance which he called "Dextrone," from sulphite liquors. This substance had special qualities. It could be mixed with glue and precipitated in the form of leather when diluted with water only. It could be used in giving strength to brown papers, in weighting jute, or as a mordant for dyes. It was of the nature of tannin, and yet it had quite distinct properties. Seeing that for every ton of chemical wood pulp produced about a ton of dextrone would be recovered from the liquors, an enormous quantity could be produced if required. This substance was not, I think, manufactured in England after the Ekman works stopped making pulp. Captain Partington has recently made use of sulphite liquors for watering the roads, and claims to get very excellent results.

Wood pulp is now used for the manufacture of nitro-cellulose, For explosives the pulp has to be of a special nature. It is also used under the name of "Cellulose Wadding," prepared under Feirabend's Patent No. 3061, where it replaced cotton wool for surgical bandages, giving most excellent results. It is also, as Pfuhl reminds us, coming into use in the form of paper in narrow strips, which are afterwards spun into filaments woven into garments, such as under Kellner-Turq processes and the Silvaline yarn process. Then, of course, it is used in considerable quantities now for manufacture of artificial silk. According to the Stern process, it is converted into viscose by Cross, Bevan and Beadle's process, and then spun into fine portions through a special solution from which it emerges in the form of filaments. For this product the inventors—all three British by the way—were awarded the Grand Prix at the last Paris Exhibition. They have also received numerous other valuable awards.

In America, where they have no esparto, the printing papers for process blocks can be produced by the aid of aspen, which fibre under the soda process makes a good substitute for esparto. I think, perhaps, not sufficient attention has been paid to the subject of the great differences in the qualities of papers made from wood pulp according to the kind of pulp used and the process adopted. Thus, on the one hand, we were able to produce soft and spongy papers, excellent for filter papers, and, on the other hand, imitation parchments from Mitscherlish pulp, close, transparent, grease-proof, the latter being produced by the aid of the basalt lava beater roll.

Then we have the milk of lime process, whereby bi-sulphite of lime is now produced by passing the fumes of sulphur through milk of lime instead of by allowing it to pass up towers filled with limestone, which is the general system in use in Sweden and Norway. The liquor made by the milk of lime process is identical with that of the ordinary method, but it has the great advantage that it produces a solution of absolute uniformity in strength, a difficult thing with the limestone, but a very important thing for ensuring regularity in the cook.

DIGESTER LININGS.

One of the most important things in the history of wood pulp has been the question of digester linings. The Mitscherlich lining in 1891 consisted of tarred pitch to protect the shell, then a layer of thin sheet lead, and on top of these two courses of specially acid-resisting bricks, formed with tongue and groove, cement being used sometimes with the bricks. Some foreign mills place the lining of lead between the two courses of bricks. In a digester heated by indirect heat, a coating of the sulphite of lime can be produced on the surface, which gives a protection for the metal. Jungend Lindig used the coating of double silicate of lime and iron. Kellner took out numerous patents for cements, consisting either of ground slate and silicate of soda, or powdered slate and glass and Portland cement. One of the earliest, and one of the most successful, linings was prepared by Wenzel, consisting of a special cement, for the most part a manufacture of Portland cement and silicate of soda, set in blocks in wooden moulds made to conform to the shape of the digester. Finally, excellent results were obtained by the use of Portland cement alone, which in many cases is reinforced by a facing of special brick or tile, the usual thickness of the cement lining being 4 in. All cement linings are more or less porous when applied, but in use soon fill up with sulphate and sulphite of lime. After numerous years of work, a great many failures, a great many patents, lawsuits, and infringements, a brick has been introduced for lining which answers the purpose. Until a suitable lining could be devised, the sulphite process could not be regarded as a success. As the early troubles with the linings made it impossible to make pulp cheaply, and the corrosion of the shell contaminated and discoloured the pulp, most

of the pulp on the market now as soda pulp in reality made under the sulphate process, which consists of a liquor containing sodium sulphate, sulphite, carbonate, caustic, which before burning to ash is fortified by the addition of sulphate of soda the sulphate being reduced to sulphite during the process of recovery. This process is cheap, but the nauseating gases evolved during the process at one time made it a difficult matter, except in out-of-the-way districts.

METHODS IN THE MILL REVOLUTIONISED.

I think, I might point out that the introduction of wood pulp has had had a considerable effect upon the way that mills are constructed nowadays in this country. Before the introduction of wood the raw materials were treated from beginning to end in the mill; now a mill buys wood pulp, which is put direct into the beaters, all the preliminary processes being obviated (except if bleached).

As to the permanency of wood papers, there is still difference of opinion. Mr. Clayton Beadle tells me he would not like to recommend even the very best bleached wood in paper required to be of an absolutely lasting character, but would give the preference to mixtures of cotton and linen. But it should be remembered that every year sees improvements in the treatment of wood, resulting in a more lasting and durable fibre. In course of time we may be compelled to alter our views.

The complete statistics bearing on the subject are much too lengthy and complicated to attempt to read in the limited time at my disposal. They will be found in the Appendix. I may, however, trouble you with one or two figures :—

In 1903, we imported into Great Britain 211,823 tons of chemical dry pulp, of the stated value of £1,842,082. This came chiefly from Sweden and Norway, and only 1,356 tons were sent to us from British Possessions. Of chemical wet pulp we introduced, in 1903, 21,279 tons almost entirely from Sweden and Norway, and value was £82,012. In the same year we imported mechanical dry, 8,268 tons, of the value of £30,192; and of mechanical wet, we imported, in 1903, 336,788 tons, of the value of £752,297.

It is worth noting that Canada supplies us with a by no means insignificant portion of the mechanical wet pulp.

In 1901, Canada sent us 48,551 tons, and in 1903, Canada supplied us with 71,664 tons of the value of £151,918. In this class of pulp, Sweden, in 1903, sent the pulp of the value of, roughly, £101,000; but Norway received £490,949 for the mechanical wet wood pulp sent to us for that year.

According to official figures, British paper makers paid :—In 1903, £1,642,082 for chemical dry pulp; £82,012 for chemical wet; £30,192 for chemical dry, and £752,397 for mechanical wet, being a total of £2,506,583.

I should be very sorry indeed to trespass on any contentious ground or to encroach on political subjects, but without taking any side in the matter, I may say that in connection with the fiscal controversy, in the event of a duty being put upon manufactured articles coming into this country, it may be somewhat difficult to classify certain kinds of wood pulp in this connection. It is a rather debateable point as to whether certain classes of wood pulp are manufactured articles or not, or to what extent it may be termed "raw material." I believe Mr. Chamberlain is credited with having been good enough to look upon wood pulp as raw material, but I do not think that this is exactly a subject which is likely to cause paper makers or pulp producers many sleepless nights in the immediate future, although the time may come when the question will have to be considered from the point of view to which I have alluded.

APPENDIX I.—PATENTS.

As will be understood, a very large number of patents have been taken out by those concerned in the development of wood pulp making, and in importance relating to the same. The following may be taken as covering some of the most important patents from 1867, when Tilghman was granted the initial patent :—

Archbold, George, 1883; manufacture of paper pulp.
Biron, Jean B. 1867; disintegrating wood to form pulp, &c.
Ekman, Carl D. 1882; treating wood; method of treating wood; treating fibrous vegetable substances to obtain fibre suitable for paper making.
Francke, David Otto, 1884; manufacture of paper pulp.
Graham, James Anthony, 1883; treating of fibrous substances.
Haskell, J. R. 1867; treating and separating vegetable fibres (not on sulphite process, but his claim covers first steaming the fibres and then condensing steam by shower of cold liquor so as to force liquor into the wood, as in later patents of Mitscherlich.
Kellner, Charles, 1886; method of sizing paper to prevent the sulphite and ground pulp from turning yellow. (He precipitates the rosin size with a sulphite salt).
Minthorn, Daniel, 1885; treating vegetable fibre.
Mitscherlish, Alex. 1886; boiling fibres with sulphite; paper pulp (process for manufacturing); 1889, manufacturing
Do do thread from short fibre.
Pictet, R. P. 1885; manufacture of pulp from wood matter.
Pond, Goldsburg H. 1886; manufacture of paper pulp from wood; machine for manufacture of wood pulp; manufacture of wood pulp.
Ritter, Eugen Baron, and Carl Kellner, 1885; apparatus and manufacture of cellulose from wood; progress of manufacturing cellulose.
Do do 1896; progress for manufacturing sulphites.
Tilghman, B. C. 1867; treating vegetable substances for making paper pulp; 1869, process of treating vegetable substances to obtain fibre.
Wheelwright, Charles S. and George E. Marshall, 1884; apparatus for treating wood.

II.—The pulp imported into Great Britain during the month of April, 1905, was :—

	Quantities.					
	Month ended 30th April.			Four months ended 30th April.		
	1903.	1904.	1905.	1903.	1904.	1905.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Mechanical :—						
Dry ...	473	228	628	2,284	2,548	2,168
Wet ...	26,666	19,145	15,770	81,953	86,597	60,538
Total ...	27,139	19,373	16,398	84,237	89,145	62,706
Chemical :—						
Dry ...	14,226	11,478	13,650	51,983	46,215	53,149
Wet ...	3,745	1,859	985	7,949	8,049	6,260
Total ...	17,971	13,337	14,635	59,932	54,264	59,409
Total of Pulp of Wood ...	45,110	32,710	31,033	144,169	143,409	122,115

Value.

	Month ended 30th April.			Four months ended 30th April.		
	1903.	1904.	1905.	1903.	1904.	1905.
Mechanical :—	£	£	£	£	£	£
Dry ...	2,348	1,047	3,141	12,273	12,443	11,058
Wet ...	60,515	42,412	36,244	191,135	189,874	140,230
Total ...	62,863	43,459	39,385	203,408	202,317	151,288
Chemical :—						
Dry ...	111,340	90,587	115,076	411,132	362,507	443,869
Wet ...	13,761	7,278	3,193	30,607	30,800	25,353
Total ...	125,101	97,865	118,269	441,739	393,307	469,222
Total declared value of Wood Pulp ...	187,964	141,324	157,654	645,147	595,624	620,510

III.—GREAT BRITAIN.

Imports of Wood Pulp compiled from the Blue Book of Annual Statement of Trade: Years 1901, 1902, 1903.

	Quantities.			Value.		
	1901.	1902.	1903.	1901.	1902.	1903
Chemical, Dry.	Tons.	Tons.	Tons.	£	£	£
From Russia ...	—	2,404	3,907	—	18,443	29,906
,, Sweden ...	84,955	102,174	127,510	746,237	824,825	971,665
,, Norway ...	52,161	57,413	62,446	457,074	466,213	490,354
,, Germany ...	2,324	3,870	5,362	21,950	32,665	45,843
,, Holland ...	3,535	5,309	4,669	35,000	46,776	40,615
,, Portugal ...	1,635	1,576	1,884	13,908	12,984	14,521
,, United States of America	7,500	2,878	3,785	63,491	23,848	31,254
,, Other Foreign Countries	2,984	695	904	25,640	5,991	7,179
Total from Foreign Countries ...	155,094	176,319	210,467	1,363,300	1,431,345	1,631,337
From British Possessions ...	18,707	9,124	1,356	154,742	76,210	10,745
Total ...	173,801	185,443	211,823	1,518,042	1,507,555	1,642,082
Chemical Wet :—						
From Sweden ...	5,638	4,587	4,908	36,986	20,994	19,908
,, Norway ...	8,383	8,358	16,339	42,371	42,281	62,846
,, Other Foreign Countries	351	216	32	3,151	1,929	158
Total from Foreign Countries ...	14,372	13,161	21,279	82,508	65,204	82,012
From Canada ...	774	—	—	5,322	—	—
Total ...	15,146	13,161	21,279	87,830	65,204	82,012

Mechanical, Dry.						
From Sweden ...	4,122	3,957	3,067	31,500	23,861	13,557
,, Norway ...	2,464	2,394	2,278	16,784	12,539	10,785
,, Germany ...	75	55	36	421	397	224
,, Holland ...	710	858	245	5,605	8,450	2,258
,, United States of America	3,789	1,727	160	27,667	11,743	1,022
,, Other Foreign Countries...	62	100	464	337	550	2,288

	Quantities.			Value		
	1901.	1902.	1903.	1901.	1902.	1903.
Total from Foreign Countries ...	11,231	9,091	6,250	82,314	57,510	30,134
From Canada ...	2,078	2,012	13	14,503	8,740	58
Total ...	13,309	11,103	6,263	96,817	66.280	30,192
Mechanical, Wet.	Tons.	Tons.	Tons.	£	£	£
From Sweden ...	8,847	32,014	46,000	27,929	73,203	100,893
,, Norway ...	187,386	211,196	217,933	532,942	516,059	490,949
,, Other Foreign Countries ...	87	—	1,191	295	—	2,567
Total from Foreign Countries ..	196,320	243,210	265,124	561,166	589,262	594,379
From Canada ...	48,551	72,635	71,664	137,789	169,420	157,918
,, Other British Possessions	1,328	247	—	4,440	494	—
Total from British Possessions ...	49,879	72,882	71,664	142,229	169,914	157,918
Total ...	246,199	316,092	336,788	703,395	759,176	752,297

—*Journal of the Society of Arts*, Vol. LIII, May 19th, 1905, pp. 27-34.

PLANT SANITATION.

Root Diseases of Tea.

BY T. PETCH.

(Illustrated.)

The literature of the plant diseases of any country shows that our knowledge of them always follows the same course of evolution. Leaf diseases always come into prominence first; when the cultivator has grasped the idea that a plant can suffer from definite diseases, he finds that stems are also liable to be attacked; and, in due time, he arrives at the conclusion that even roots are not immune. Ceylon exhibits the development of these phases in a marked degree. Coffee leaf disease was followed by tea leaf disease; then came cacao canker, and after some years, tea root disease. But it must not be assumed from this sequence, that there was no "canker" in the days of coffee, or no root disease in the early days of "Grey Blight." There is little doubt that such diseases existed though their effects may have been masked by the more prevalent leaf diseases, Moreover, there is always a tendency to attribute all diseases to one cause, and it generally happens that what is at first thought to be one disease proves on further examination to be half a dozen. As has been pointed out before, this sub-division does not indicate a greater amount of disease, but it may in some cases, with a fuller knowledge of the fungi, suggest other methods of dealing with them.

The Peradeniya Circular on "Root Disease in Tea" (Vol. II., No. 6, July, 1903,) refers briefly to the possibility that the great variability observed in the appearance of the roots of tea bushes killed by root disease may indicate that the cause is not in all cases the fungus (*Rosellinia radiciperda*, Mass.) therein described. It has now been ascertained by numerous cultivations of the mycelium on dead or dying roots, that there are several distinct fungi which attack the roots of tea, and judging from the number of specimens submitted, *Rosellinia* is one of the less common of these.

UPCOUNTRY TEA ROOT DISEASE.

The root disease which appears to be most prevalent above 4,000 feet is easily distinguished from *Rosellinia*. When the dying bush is uprooted in the ordinary way, the root is seen to be covered with small white raised patches or knobs, seldom exceeding one-tenth of an inch in diameter. The margin of these nodules is reddish, and in some cases there may be also coarse reddish strands spreading over the surface of the root. From these nodules a mycelium spreads to other roots; this is white at first, but subsequently forms a thick cord with a tough red coat. The mycelium between the bark and the wood forms a thin continuous white sheet. In the majority of cases, the root decays completely and can be rubbed into powder; frequently one finds, on breaking it up, a thin gelatinous red sheet extending across the dead root, but I have not yet seen any fructification on tea bushes in the field.

But by cultivation under suitable conditions, the fructification is easily obtained. This generally appears on the stem just above ground; it may, however, grow out horizontally on the surface of the soil, and in one cultivation the mycelium spread downwards from the root and produced the fructification on the under surface of the flower pot. The latter occurrence illustrates the travelling power of the fungus. The fructification (sporophore) forms a white or pinkish patch, several inches in diameter, studded with minute holes, adhering to the stem. Beneath the comparatively soft upper tissue, and lying next to the wood or soil, is a red horny

Photo by T. Petch.

"LOW-COUNTRY" TEA ROOT DISEASE.

($\frac{1}{2}$ NATURAL SIZE.)

Photo by T. Petch.

"UP-COUNTRY" TEA ROOT DISEASE.

($\frac{1}{3}$ NATURAL SIZE.)

layer. The edge of the growing sporophore is white, in old specimens it is red and horny. In the photograph, the sporophore is just above the collar, (*i.e.*, half way up the figure), and the red edge is well marked on the lower side. The minute holes are the openings of close-packed tubes in which the spores are produced. The fungus thus belongs to the same family as that which causes root disease in Hevea. It was named *Poria hypolateritia* by Berkeley years ago from Indian specimens, and owes its name to the underlying hard, red layer.

This appears to be the fungus which spreads to the tea from the roots of *Symplocos spicata*, the Bombu; but in some instances jungle stumps are not present, and it seems probable that the infection in these cases is brought about by spores. The fungus is fairly common in upcountry jungles on dead logs, *e.g.*, at Hakgala and Pattipola.

LOWCOUNTRY TEA ROOT DISEASE.

In the lowcountry districts, all root disease in tea appears to be caused by one species of fungus. The indications on dying roots are not as clear as those of *Poria* or *Rosellinia*, but there is no difficulty in finding them once they have been pointed out. The roots show small black nodules or warts, which probably give rise to underground mycelium, though this has not been clearly established. The mycelium between the wood and bark spreads in white or yellowish fan-shaped patches which acquire a black edge when they meet a crack in the bark. Irregular black lines are seen in a cross section of the root.

The fructification appears on the lower part of the stem, emerging through a crack in the bark in the form of a white swollen cushion. This spreads over the surface as a more or less flattened white plate which finally becomes grey and concentrically zoned. The photograph shows two fructifications on the right, one half ripe and the other just developing ; the latter is not yet zoned. The remaining fructifications (on the left) have been spoilt to some extent by insects. When quite ripe, it is a grey, concentrically zoned plate marked with minute black dots : it lies close to the surface of the stem but is only attached at one point. The under surface is black, and the whole structure is hard and brittle. Two kinds of spores are produced. The first are borne on the outer surface when the fungus is wholly white ; the specimen (in the photograph) just developing is in this condition. The second are produced when the fungus is quite ripe, in minute chambers whose openings are the black points previously referred to. The fungus is an undescribed species of *Ustulina*. Its distribution in the lowcountry has not yet been ascertained, and it is not yet known whether it spreads to the tea from any particular species of tree. There are specimens in the Herbarium, collected in 1868, labelled "Central Province, and South of the Island ;" these agree in shape with the form described above. A slightly different form occurs on tea bushes in the field ; this grows to a height of half an inch, beginning with a very thin base, and widening out to a flat circular top, about a quarter of an inch in diameter. Several of these structures grow together, and the group then resembles a different order of fungi ; but they develop with the other form under cultivation, and sometimes the heads fuse into the usual large flat plate. I have gathered the fructification from tea bushes which showed hardly any sign of disease, and it seems most probable from this, that the progress of the fungus is very slow.

ROSELLINIA.

Rosellinias are fairly plentiful in the tropics. There are twelve species among the fungi collected by Thwaites, and one of these, *Rosellinia bunodes*, has been found to be the cause of root disease in Southern India. It has recently been collected in Ceylon but, as far as is known at present, it is not one of those which attack tea in this country. There appear to be two species on tea, one of which also

attacks camphor and *Panax*. They differ from the other tea root diseases in that their mycelium is to a great extent external. One of our species covers the root with black strands; the other forms a loose coating which is at first white and afterwards smoky grey or black. When the mycelium penetrates the bark it spreads out in the shape of stars over the wood. With a microscope there is never any difficulty in determining *Rosellinia* mycelium as it shows peculiar characteristic swellings on the hyphae.

The difficulty of obtaining the ascospore fructification (perithecia), either in cultivation or in the field, has been repeatedly referred to. These are small black spherical bodies about one-twelfth of an inch in diameter, and they usually grow in clusters. I have one specimen, presumably on tea, and others on Panax, but in each case there is some doubt whether they were connected with the mycelium on the roots. Neither of these is *Rosellinia radiciperda*, Mass., and this species has most probably not occurred in Ceylon. These fructifications can only be produced above ground, and are most likely to be found at the base of the stem.

But another fact in the life history of *Rosellinia* has been completely overlooked in dealing with the Ceylon disease. As soon as, often before, the bush is dead, another form of spore is produced in myriads on the stem. The lower part of the stem, sometimes to a height of a foot, is covered with a black velvety coat of close-set erect hyphae which bear innumerable spores at their extremities. When these spores are produced the surface is grey with them. I have had tea stems attacked by *Rosellinia* under cultivation for more than a year, and during the whole time there has been a constant succession of crops of these spores. It is probable that these serve for the propagation of the fungus under ordinary conditions, and that the ascospores—which are resting spores enabling the fungus to survive unfavourable conditions—are rarely produced. It follows that it is a waste of time to trench round diseased areas without at the same time burning the dead and dying bushes; and these should be burnt on the spot, if possible, as carrying them about the estate will inevitably spread the spores. Most of the cases of *Rosellinia* sent in are in this spore-bearing stage.

In dealing with the *Rosellinia* on Panax, it was found that the mycelium spread on the surface of the soil among the dead leaves at the base of the hedge, and it was impossible to stop it until these had been raked away. In most cases the disease originates on Grevillea stumps and spreads underground. *Rosellinia* is apparently not known in lowcountry districts, but may be found in all others.

PREVENTIVE MEASURES.

When a bush is attacked by root disease, there is practically no hope of saving it. All measures must be directed to preventing the spread of the fungus to neighbouring bushes. As the mycelium spreads under ground, and usually within the first foot of the soil, trenches about eighteen inches deep must be dug round the dying bushes in order to isolate them. It is better to include within the area enclosed by the trench a ring of the surrounding apparently healthy bushes, since it is most probable that the mycelium will already have advanced underground as far as these. The dead bushes within this area must be dug out and burned; this is especially necessary in the case of *Rosellinia*, because the spores of the fungus are always produced as soon as the bush is dead and are soon blown away. Carrying the bushes about the estate should be avoided as far as possible. When this must be done with *Rosellinia* affected bushes, the stem should be scorched, by burning some material at the base or by applying a torch before, the bushes are dug up. The ground from which the bushes have been removed should be forked over with quicklime and left exposed for a year.

Burial of Prunings.

The burial of prunings is a practice peculiar to tea cultivation. Its advantages are theoretically two-fold. Breaking up the upper layers of the soil preserves the moisture in the subsoil, so that cultivated lands lose less in times of drought than those uncultivated; and to some extent the burial of prunings thus ensures a cultivation, at least a partial one, which would not otherwise be obtained in tea growing. In the second place, the nitrogen in the prunings is ultimately converted into food for the plant. As most of the objections to treating prunings in any other way are based on the loss of nitrogen, it is worth while to enquire further into this point.

The nitrogen is of no use to the plant until it is converted into nitrate. The prunings are decomposed by bacteria, or fungi, or both, and the nitrogen in the residue is converted by other more specialised bacteria into nitrate. Now, although, in Ceylon, leaves and twigs decay fairly rapidly on the surface of the soil, it seems to be a well-authenticated fact that prunings buried in holes persist for a much longer time than they would in temperate climates. I have had prunings, dug up at the end of six months, which showed hardly any decay; they had been buried in the approved fashion with basic slag. It seems probable that at least one factor militates against the successful working of soil bacteria; they do not flourish in an acid medium. When the medium, *i.e.*, soil or prunings, becomes in the slightest degree acid, decomposition can only be effected by fungi. The growth of fungi on the prunings indicates that the medium is acid. The amount of lime in the basic slag is apparently insufficient to neutralise the acids formed by the organic matter. It may be suggested that the slow decay is connected with a decomposition by fungi only,

When the prunings are decomposed, the nitrogen has still to be converted into nitrate by special nitrifying bacteria. These again do not flourish in an acid medium (they are absent from peaty soils); they are practically confined to the first nine inches of the soil, and they require for successful working a free aeration of the soil and a base to neutralise the acids produced. With deep burying as usually practised, it cannot be said that any of these conditions are realised and the process of conversion will, to say the least, certainly not be rapid. Until the bacteriology of the process has been examined, it must remain a moot point, how much of the improvement noted after burying prunings is due to the nitration of the nitrogen in them, and how much is due merely to the disturbance of the soil.

But where root disease is known to exist, the burial of prunings should certainly be discontinued. We are relying on fungi for their preliminary decomposition, and as all the tea root fungi can live comfortably as saprophytes, the process is a cordial invitation to them to extend their operations. Except in the case of *Rosellinia*, exact proof of their acceptance can only be obtained by growing to maturity the mycelium found in the holes, and as the material even from one hole is no small quantity, pot cultivations must evidently be pretty extensive if any positive result is to be obtained. This is now being attempted in the case of the low-country tea root disease. The species which causes the disease has not yet been obtained from them, but more than half of those which have grown from the prunings belong to the same group of fungi. I agree that no hard and fast rule can be laid down in this matter, but I must point out that in several recent instances objections of this type have always been made *after* the hard and fast rule has been laid down by the advocates of one practice.

I shall be glad to receive, from the lowcountry for the present, samples of prunings taken from the holes six months after burial. Those which show some mycelium should be included, but the sample should not consist wholly of these. They should be packed in tins to avoid death or retardation from drying; two 1 lb. biscuit tins would afford sufficient material for one pot. Details of any root disease should accompany the specimens,

NOTE ON ABOVE BY THE GOVERNMENT ENTOMOLOGIST.

Considering the burial of prunings from an entomological point of view, this treatment is undoubtedly useful in the reduction of many insect pests, but is not so efficient as burning. It is seldom that prunings are so completely buried as to prevent the escape of a certain proportion of the insects that may be infesting them.

But though—regarded as a direct means for the control of insect pests—burial is inferior to burning, it has a distinct indirect effect in improving the health of the plant and so enabling it to better withstand its enemies, This effect has been repeatedly noticed in the case of 'shot-hole borer.' Fields in which the prunings have been buried, *with a sufficiency of lime*, have continued to give good and even increasing crops in spite of the constant attacks of the borer; while fields in which the prunings have been systematically burned—year after year—*without the addition of an equivalent in nitrogenous manures*, have steadily decreased in yield.

This improvement following the burial of prunings is probably dependent *upon the incompleteness of the process*-*vide* the Mycologist's remarks upon the conditions necessary for the proper development of the nitrifying bacteria.

E. ERNEST GREEN,
Govt. Entomologist.

Royal Botanic Gardens, Peradeniya, 20th March, 1907.

[Burial of prunings is obviously one of those matters about which at present no hard and fast rule can be laid down. It may depend, for instance, upon whether the field is subject to root disease or to shot-hole borer—ED. *T.A.*]

Entomological Notes.

BY E. ERNEST GREEN, *Government Entomologist.*

I have received an interesting communication from a correspondent in the Nilambe district who reports the successful treatment of 'Nettle Grubs' (*Thosea recta*) by spraying with Jeye's Fluid. He writes:—"To commence with I used three ordinary cigarette tins of Jeye's Fluid to a Kerosene oil tin of water. At this strength it killed all the grub within three or four hours. But I found it injured the young shoots, so tried two tins of the fluid to one oil tin of water. Directly the bushes were sprayed, all the grubs at once fell to the ground. After about six hours I found about 50 per cent. dead and the others climbing up the trees again; but as far as I can judge they did no more damage, and in four days I could not find a living one on the bushes, nor have the bushes that were sprayed been reinfected. The proportions of mixture were one part of Jeye's Fluid to 35 parts of water." The total cost worked out at approximately Rs. 2·25 per acre.

Cacao on an estate in the Moneragala district has been seriously affected by *Helopeltis*. Both the young foliage and the fruit are said to have suffered severely. This excessive attack has followed closely upon the removal of all the shade trees.

The Funtumia (Kickxia rubber) trees on the same estate as elsewhere are repeatedly defoliated by the leaf-rolling caterpillar of a moth (*Caprinia conchylalis*). There is no practical remedy for this pest which is an indigenous insect, breeding on various local shrubs. Any treatment can be only temporary and fresh attacks are bound to occur.

I have on more than one occasion received reports of reputed damage to rubber plants and stumps by Dragon-flies, and a detailed statement of such supposed damage appeared in one of the local papers some weeks ago. The Dragon-

flies were said to be found perched on the ends of the stumps, engaged in sucking the sap! This is, of course, an error of observation. Dragon-flies are purely insectivorous and—far from occasioning any injury—should be regarded as highly beneficial insects. They are fond of taking up their position on any vantage ground from which an uninterrupted view is obtainable on all sides. This will account for their presence on the ends of the rubber stumps. From such a perch they would be ready to pounce upon any smaller insect that might come within their range of vision.

With reference to an earlier note ("*T. A*". Dec., 1906), on a boring beetle in camphor plants, it appears that this is not the only insect that is undeterred by the presence of camphor in the wood. In a recent report issued by the Jamaican Board of Agriculture is a note on a species of Weevil (*Hilipus elegans*, Guerin) which tunnels into the stems and larger branches of the camphor trees in Jamaica.

Castor-oil (*Ricinus*) plants, on the Silk Farm, Peradeniya, have been badly infested by a 'scale-bug,' *Diaspis pentagona*, Targ. The insects are massed round the collar and lower parts of the stem, resulting in decay of the cambial tissues and the consequent death of the affected plants.

The specimens of 'Copra' (dried coconut) in the R. B. G. Museum have been completely destroyed by the larvæ of a Pyralid moth (*Ephestia cautella*, Walk). This little insect is destructive to many kinds of stored foods. I have previously bred it from almonds, dried cacao beans, and cake-chocolate.

Considerable and annoying loss in vegetable and flower gardens often occurs from the attacks of an ant (*Dorylus indicus*). These little insects are often mistaken for Termites, but are true ants and not even distantly related to the 'white-ants.' They will tunnel into the tubers of potatoes and dahlias and attack the roots of a large number of other plants. 'Vaporite' will be found an effective check to this pest. It appears to be fatal to all subterranean insects. But it must be applied carefully, or it may injure the plants also. The best plan is to mix the Vaporite with the soil (in the proportion of 1½ oz. to the square yard) about a week before the plants or seed are put out. When applied to growing plants, it should be dibbled into the soil at a little distance from the roots.

In Theobald's 'Monograph of the Culicidæ of the World' (Vol. IV., p. 1), the value of 'duckweed' (*Lemna*) as a means of preventing the breeding of mosquitoes is put forward with strong corroborative evidence. It is suggested that this plant might be cultivated in many ponds and pools where mosquitoes now habitually breed. The 'duckweed' forms a close covering on the surface of the water and constitutes a mechanical obstruction to the deposition of the mosquitoes' eggs. Two species of *Lemna* (*paucicostata* and *polyrhiza*) occur in Ceylon, and are recorded by Trimen as common. But the only locality in which I have observed pools densely covered with 'duckweed' is Anuradhapura. Another plant that should be equally or even more useful is the *Utricularia*, several species of which flourish in still water. These plants have numerous small bladder-like organs in which small insects become entrapped and killed.

SCIENTIFIC AGRICULTURE.

THE IMPORTANCE OF HUMUS IN TROPICAL AGRICULTURE.

WITH SPECIAL REFERENCE TO CACAO CULTIVATION.

The recently-issued report for 1905-06 on the Botanic Station of Dominica (Imperial Department of Agriculture for the West Indies) contains a summary by Dr. Francis Watts, C.M.G., the Superintendent of Agriculture for the Leeward Islands, of the results obtained on a series of plots devoted to manurial experiments with cacao. These particular experiments, inasmuch as their results indicate a remunerative method of manuring cocoa trees, are naturally of great local value. They also have a wider interest as throwing light on one of the fundamental problems of tropical agriculture, namely, the preservation of humus.

In the scheme of experiments, some 1¾ acres, bearing cacao trees about 10 years old, were divided up into five plots, which were treated as follows from 1900 onwards :—

A. No manure.

B. Basic phosphate, 4 cwt. per acre. Sulphate of potash, 1½ cwt. per acre.

C. Dried blood, 4 cwt. per acre.

D. Basic phosphate, 4 cwt. per acre. Sulphate of potash, 1½ cwt. per acre. Dried blood, 4 cwt. per acre.

E. Mulched with grass and leaves.

The individual trees were thus manured year after year in exactly the same way, and the cumulative results are comparable to those which would be obtained in actual estate practice. The first point established was that the treatment with nitrogenous manures was remunerative. Thus, to take the last year, the net financial result with plot B, which received phosphate and potash and no nitrogen, was a loss at the rate of £4. 4s. 3d. per acre ; on the other hand, on both plots to which nitrogen was added there was a gain, that is to say, the increased value of the crops more than compensated for the cost of the manure ; plot C gave a net gain on manuring of £4 8s. per acre, and plot D of £8. 0s. 4d. per acre.

Still more striking, however, was the result obtained on the fifth plot, E, manured with grass and leaves, the gain on manuring being at the rate of not less than £20. 16s. 6d. per acre. That this was no accidental result is well brought out in the diagrammatic summary of the experiments accompanying the report, in which the yields of "wet" cacao are plotted by means of lines on a uniform scale for the years 1903-06. From this diagram it can clearly be seen that the mulch of grass and leaves, whilst of slower action than more readily available manures, is more lasting in its effects. The mulched plot, E, was beaten by C and D in 1903, tied with C in 1904, beat both in 1905, and altogether outdistanced them in 1906.

The material employed for mulching consisted chiefly of lawn mowings and the fallen leaves of neighbouring trees, particularly *Pithecolobium saman*, the well-known "Guango" or "Rain" tree. The general suggestion is made that grass, etc., from uncultivated lands might commonly be used for mulching cacao, or if no waste land is to hand, that certain areas should be set aside and used for the production of material for mulching.

These results are worthy of serious consideration in many parts of the tropics where the provision of chemical manures is often expensive, and where also the humus of the soil rapidly disappears and needs replenishing. The beneficial nature of such manuring will probably be apparent not only with cacao, but also other crops, especially those which owing to their casting a deep shade or for other reasons do not allow a mulch to grow under them.—*Bulletin of the Imperial Institute*, Vol. IV, No. 4, 1906.

MISCELLANEOUS.

Lessons in Elementary Botany. IX.

BY J. C. WILLIS.

*Floral Mechanisms.**—It is evident that if a visiting insect is to be of any use in carrying pollen to the stigmas, that part of its body that touches the pollen must also touch the stigma. This is simple enough when the male and female flowers are separate, but in the vast majority of plants the flowers are both male and female. In order that both may touch the insect at the same, or nearly the same point, the anthers and the stigma must be placed near together, and the various ways in which this is done without at once causing self-pollination are of some interest.

Male and female flowers occur in a good many upcountry plants, but this method of separation is rare.

Heterostylism, or the possession of two forms of flowers, one with long and one with short style, is not uncommon. The common patana herb, *Knoxia platycarpa*, with its white or pinkish flowers, open all the year round, shows this phenomenon very clearly. On one plant all the flowers have a long style sticking out of the corolla. while the stamens are hidden, and on another plant only the stamens stick out, and the style is hidden. Now it is found that in the case of a plant like this, good seed is only set if pollen be taken from a long stamen to a long style, or from a short stamen to a short style, *i.e.*, from one plant to another, and it is obvious that insects will be more likely to do this, provided they go to several plants, than to take pollen from a short stamen to a long style, or from a long to a short. Illegitimate pollination, as the latter is called, usually results in no seeds being set at all, or only very few and infertile ones.

Perhaps the most widespread arrangement is what is called *dichogamy* or separation of the sexes in time, the stamens being ripe first, the stigma afterwards, or *vice versa*. This is extremely common, and is usually accompanied by a movement of the parts, so that at one time the stamens, at another the style, stand in the way of the visiting insect. Most of the plants of the family Compositae (daisies, dandelions, chrysanthemums, and similar plants), for example, are what is called *protandrous* (male first), the stamens being ripe before the stigma, which comes up through the tube made by the anthers, pushing out the pollen at the top. Later on the stigma emerges, and opens out, but by this time all the pollen has gone.

Another very common, but less perfect arrangement is that while the stamens and style stand very near together, the latter projects a little further out, so as to be first touched by the visiting insect, which may rub off upon it any pollen that it carries.

Yet another common arrangement is what may be called " loose-pollen, " the pollen being held in a kind of box formed by the anthers, and shaken out upon the head of any insect visiting the flower. The style in such a flower usually projects further than the stamens.

*Some illustrative figures will be given next time.

Literature of Economic Botany and Agriculture. XVI.

BY J. C. WILLIS.

Ipecacuanha.—Dethan, Sur l'ipecac. strié majeur. Journ. de Pharm. VII. 1898. B. C. 78, 1899, p. 122 (adulteration with Psychotria).
Report Ootacamund Bot. Gdn. 1898-9, p. 11.
Ipecacuanha. Planting Opin. 10, 2, 1900, p. 100.
Hartwich, Einige falsche Ipecacuanha-wurzeln. Just's Jahresb. 27, 1899, II, p. 29.
Physiological action of Ipecac. Alkaloids. Ch. and Dr. 11, 7, 1903, p. 68.

Jalap.—The position of Jalap. Ch. & Dr. 14, 1, 1899, p. 58.

Japan Wax.—Japan Wax and Varnish. Jam. Bull. 1900, p. 37.

Jatropha.—*J. Curcas* (detailed account). Ind. Merc. 15, 5, 1900, p. 315.

Juniper.—Uganda Juniper. Kew Bull. 1899, p. 197.

Jute.—Jute, past and present. Ind. Agric. June 1900, p. 187.
Jute cultivation in Bengal. do. July 1900, p. 220.
Bimlipatam Jute. Agr. Ledger, V. P. series, 77, 1903.
Jute (varieties) Revue. Cult. Col. June 1904, p. 358.
Culture du jute au Tonkin. Bull. Jard. Col. May 1904, p. 647.
Comptes rendus des expériences d'engrais . . . Bull. Econ. Indo-chine, Nov. 1904, p. 1149.
Experiences sur le rouissage du jute. do. p. 1174.
Deterioration of jute. Ind. Agric. Feb. 1905, p. 44.
Jute adulteration. do. June, 1906, p. 172.
Produktion und Verbrauch von Jute. Tropenpfl. 10, 1906, p. 676.
Jute experiments in Bengal. Report Dept. Agr. India, 1904-5, p. 105.
La germination du jute. Journ. d'Agr. trop. Apr. 1906, p. 110.
The extension of jute cultivation in India. Bull. Agr. Res. Inst. Pusa, 3, 1906.

Kapok.—(and see Fibres) Le Kapok et son usage en medicine. Bull. Ec. Indo-chine, Nov. 1904, p. 1257.
Une campagne contre le Kapok. Journ. d'Agr. trop., Dec. 1905, p. 365.
Kapok or Silk cotton. T.A., Apr. 1906, p. 213.

Kino.—E. African Kino. Ch. & Dr. 3, 1, 1903, p. 34.

Kola.—Die Boden-und Klima-Aussprüche des Kola-baums. Tropenpfl. III., 1899, p. 519.
Schumann, Die Mutterpflanze der echten Kola. Notizbl. Berlin, III., 1900, p. 11.
Verwertung der Kolanuss auf Kamerun. Tropenfl. IV. 1900, p. 80.
Kola in Kamerun. do. p. 120.
Ueber der Stammpflanzen der Kolanuss. do. p. 219.
Kola-nut. Jamaica Bull. 1900, p. 154.
See Just's Jahresbericht, 1898, II., p. 99, &c.
Ueber den Stand der Kolapflanzung . . . . . . in Misahöhebezirk. Tropenpfl. V., 1901, p. 17.
Tschirch, Notiz über Cola. Flora, 88, p. 242.
Ueber Kola in Verbindung mit Tabak. Just's Jahresb. 1899, II., p. 7.
Quelques mots sur le Kola en Afrique occidentale. Rev. Cult. Col. 1901, p. 366.
Kola nuts. W. Ind. Bull. IV., 1902, p. 182.
Market rates for Kola. Agr. News, 26, 3, 1904.
Einige Bemerkungen ueber den Kola in Togo. Tropenfl. 1904, p. 192.
Kola on the Gold Coast. Gonner in do. 1904, Aug. &c.

Kola. Kew Bull, 1906, p. 89.

Les Kolatiers et les Kolas. Bull. Jard. Col. 1906, p. 129.

Le Kolatier au Dahomey. do. p. 208.

Report on Cacao and Kola industries on the Gold Coast. "T.A.", Aug. 1906 p. 146.

Lac.—The Lac industry of Assam. Ind. Agric., May 1900, p. 138.

The Analysis of Shellac. Parry in Chemist & Dr. 26, 10, 1901, p. 689, and 31, 1, 1903, p. 175.

Les arbres à lac de l'Indo-chine. Bull. Ec. Indo-chine, 8, p. 599.

Ueber der Japanlack. Tropenpfl. 10, 1906, p. 48.

Lantana.—Lantana. Ind. Merc. 31, 10, 1905, p. 745.

BLACK COTTON SOIL IRRIGATION.

Somewhere about a year or so ago the Madras Government decided that it was desirable to carry out experiments in 'basin' irrigation on the black cotton soil of the Bellary district, because as they had been informed, it was under that system of irrigation that the cotton crops of Egypt are grown. They also decided that other experiments in irrigating that sort of land should be made, and to that end have established an experimental farm at Hagri. The idea dominating this final resolve is no doubt most excellent, for with the experience of the Kurnool Cuddapah canal before them and the warnings that one agricultural expert after another has given on the subject of attempting to irrigate such soil, no other course could be reasonably adopted. It is a matter for wonder that the idea has not been earlier given effect to. Water is such an incalculable benefit in Indian agriculture that too often the fact is lost sight of that it is not sufficient to bring the water to the land, but that it is also necessary to drain it away again; and in the case of black cotton soil this is one of the greatest difficulties. Besides this, such soil possesses a very peculiar physical character of its own, termed colloid, which when it is wetted brings it into a state that renders all tillage for a time impossible, and the land is so retentive of moisture that it remains cold and unfavourable to the growth of plants for a long time if it becomes wet. Thus its irrigation is fraught with difficulty, whilst its capillarity is so great that in the evaporation of moisture from its surface enormous amounts of soluble salts—alkalies—are brought to the surface and the soil is rendered, if not sterile, at least comparatively unproductive whilst the presence of these salts renders the cultivation of such land even more difficult than it naturally is. The Madras Government hoped great things from Egyptian experience, and even went so far as to propose that one of their new European Superintendents of Farms should spend a month (a very short period) in Egypt to make himself acquainted with irrigational practice in that country whilst on his way to India. This proposal does not appear as yet to have been given effect to—and perhaps it is as well.

However, any information that bears on the irrigation practice of Egypt is of interest, and in Mr. Sidney Peel's "Binding of the Nile" we find a fairly complete account of Egyptian practice. The work is defective in that the information as to the character of the soils met with is extremely limited; and this could only be supplied satisfactorily if the Indian Government were to undertake an investigation on their own behalf and to entrust it to some one having a thorough knowledge of Indian agricultural conditions and practice. Still, the information given is sufficient to give the Government of Madras pause in their resolutions, for their idea is that under the Tungabhadra Project large areas of cotton may be irrigated. Now in Egypt the bulk of the cotton crop is grown in Lower Egypt, or the Delta,

and there all the cultivation is carried on under what is termed "perennial" irrigation; that is, irrigation all the year round as opposed to "basin" irrigation, or irrigation during the flood season only. And it is to the improvement in the irrigation supplies of lower Egypt that the great extension of cotton cultivation there has been due, for cotton is a summer crop in Egypt, as contrasted with the clover, beans, wheat and barley of the winter, and the maize, rice or fallow of the flood season. This crop is sown there from the end of February till the beginning of April after the land has been watered, and it is watered again after sowing; and thereafter until the flood season comes round once in three weeks or so, whilst the harvest lasts from some time in August until November.

Thus in their hope that the Egyptian basin irrigation system would prove of advantage to the Bellary cotton growing ryot, the Madras Government may perhaps be disappointed. Whether there is any more reason to hope for benefits accruing from an adoption of that system for other crops is also extremely doubtful, as it is being abandoned in Egypt wherever perennial irrigation is possible, and is a most wasteful system with regard to the quantity of water used. In fact, the "basin" system of irrigation is only possible under peculiar conditions of supply when that cannot be regulated otherwise, for with the enormous flood rise of the Nile it acts as a safety valve and enables large temporary storage to be made in a manner very similar to the large shallow tanks of the Carnatic, and this temporary storage leads to a great secondary benefit, in that the land receives a deposit of fertilising silt from the river waters stored on it. In August and September the basins are filling, and during the two following months they are discharging, those highest up the valley being emptied first, as the Nile flood falls. During flood time all field work is necessarily at a standstill, and if the flood is at all prolonged it causes great damage, not only by seriously retarding the sowing season, but also by waterlogging the land and thus increasing the injury done by excessive quantities of soluble salts in the land.

In Egyptian agricultural practice there is probably much to be learnt that would be of value in Southern India; but the idea that anyone who had no knowledge of the agricultural conditions of Southern India could in the course of a few weeks glean the information that would be of value is absurd. The matter should not be allowed to drop, but should be carried out in the manner suggested. It is rather by study of agricultural practice in such countries as Egypt, Italy, Java, Japan, etc., than in England or America, that lines for improvement on Indian practice may be found, and whilst so much attention is being given to experimental investigation in India, this line of investigation should not be neglected.—*Indian Agriculturist.*

CO-OPERATIVE CREDIT IN INDIA.

From a financial point of view the progress of the Indian agriculturist may be said to depend largely upon the elimination of the money lender. There is no need of vilifying the usurer in order to arrive at this conclusion. On the contrary, the fact must be recognised that as Indian rural society is now constituted, the small capitalist who lends out his money is absolutely essential. In an imperfect way he performs the functions of a banker, and, whatever may be his shortcomings, he brings to his task qualifications from the lack of which the ordinary bank is compelled to stand aside. But the money lender is undoubtedly an expensive boon, and, as most persons are aware, the efforts of the local Governments have latterly been directed towards providing an effective substitute in the form of co-operative societies. It may be said in general terms that these organisations have been remarkably successful. They have assisted their members at reasonable rates, and

they have paid their way. Yet, for some reason, they are not extending with the rapidity which their utility would lead one to expect. We regret to note that the Registrar of Co-operative Societies in Eastern Bengal confesses in his last annual report that he has not met with the success which he had hoped for in the formation of new societies. One cause which he suggests as accounting for this failure furnishes additional evidence of the mischievous effects of the policy pursued by the late Lieutenant-Governor. "The feelings of the educated classes," writes the Registrar, "have been much agitated, and I found it difficult to reach the cultivators without the help of the more respectable community." The political moral lies on the surface. Throughout the recent troubles the tendency has been to minimize the influence of the educated classes, on the assumption that they represented only themselves, and that the inarticulate masses would, if they could be consulted, dissociate themselves from their so-called leaders. The admission of the Registrar tends to disprove this hypothesis. The educated people are, in a very real and practical sense, the leaders of the community. "The cultivators," the Registrar continues, "look at the movements initiated by Government with suspicion, and will not believe in any Society which is not approved by the educated people of the village, whom they are accustomed to follow and look up to in all strange matters." But, while laying stress on the obvious expediency of conciliating the educated classes, we are bound to express our surprise at the part they have taken in creating a prejudice against the spread of institutions which are so clearly beneficial to the cultivators. Nothing could be more foolish than to adopt or encourage a hostile attitude towards valuable reforms in order to spite a Government which has nothing to lose if they are rejected. The highest wisdom in politics is to accept all that can be got and ask for more. Political discontent was, however, not the only circumstance which contributed to the indifferent success in the promotion of co-operative societies. The social conditions to be contended against were unfavourable. On the one hand there was the indifference of the Zemindars. The land system of Bengal encourages that worst evil of private ownership,—absenteeism. The majority of the landowners live away from their estates and "take but little interest in the welfare of their tenants," who are consequently left without guidance. On the other hand, there are, as might have been anticipated, certain influences which are from interested motives opposed to any reform calculated to interfere with the profits of moneylending. Individual moneylending, as contrasted with the banking system, is exceedingly rife in India. "The richer people," observes the Registrar, "are almost all moneylenders and kept aloof from the societies when they did not actively oppose." Again, "many of the petty landlords are themselves usurers and opposed to this movement." One of the results of this combination of apathy and hostility is that capital to finance the societies in their early stages is difficult to obtain, and for this condition of things aid from the Government seems to be the only remedy. Happily, help can be given without much risk of loss.—*Indian Agriculturist.*

AGRICULTURAL CO-OPERATION.

BY E. T. MULLENS,

Secretary, Minister of Agriculture, Natal.

This article has been prepared with a view of answering the question "What is the best form of Agricultural Co-operation for Natal?" In order to arrive at an answer to this question it is, first of all, necessary to ascertain what has been done in other countries, so that the errors into which the pioneers of the movement fell may not be repeated in this Colony, and that we may profit by the accumulated experience now available.

Fortunately, very full information upon this subject of Agricultural Co-operation—or, as it is sometimes called, "the New Agriculture"—is now to be had. Practically the whole of this article is based upon information gleaned from the various publications of the Department of Agriculture and Technical Instruction for Ireland, as well as from the invaluable work of Mr. E. A. Pratt on "The Organisation of Agriculture." This latter work relates in clear and popular language the history of Agricultural Co-operation in every part of the world; and no society or group of individuals contemplating co-operative action can do better than purchase a copy of the work in question, which can be obtained from Messrs. P. Davis and Sons, Maritzburg. The Natal Department of Agriculture is collecting all other available information in regard to agricultural co-operation, and will be able to supply applicants such information as may be needed by those intending to start co-operative societies, including model sets of rules.

Denmark is acknowledged, by all those who have investigated the subject, to be far and away ahead of all other countries in the matter of Agricultural Co-operation; and a short description of what has been done there will give a good idea of the enormous advantages—in fact the revolution—brought about by agricultural co-operation. As a result of the various European wars, Denmark, from an agricultural point of view, had been practically ruined—having, in addition to the ordinary devastation wrought by wars, been deprived of the best of her agricultural land, and reduced to narrow limits. Of this limited area, a substantial proportion consisted of mere marsh and dune land—fit apparently for nothing but wind and storms to blow over. With a view to renovating the country, the Danish Heath Society was started in 1866. Roads were made, irrigation schemes were carried out, colonies were established, railways were constructed, and plantations were arranged, the final outcome of the Society's work being that 25,000 acres of sandy land were converted into productive soil, 75,000 acres were planted with conifers, two experiment stations were established, and 400 demonstration fields organised in all parts of the country where heath land was to be found. Subsequently, efforts were made by other societies to improve the dairying industry, and, in conjunction with this, poultry and pigs were taken up. As the dairying industry developed, and England became the chief market for Denmark, the Danish Government sent experts to Ireland, to enquire into the methods of breeding and rearing which then obtained in producing the quality of pig required by the Irish Bacon Curer's Association. Pigs were imported from Ireland into Denmark, and, as a consequence of the co-operative movement, such progress was made with the ham and bacon business, that Denmark practically succeeded in driving the Irish ham and bacon industry out of the English market. As a result of efforts made by Sir Horace Plunkett to restore agriculture in Ireland, an Irish Department of Agriculture was formed, and, in 1903, at the instance of the Department of Agriculture, a deputation, representing the Irish Agricultural Industry, was in its turn sent to Denmark, to enquire into the bacon-curing industry of that country, and to endeavour to find out what methods had been followed by the Danish farmers and merchants in so successfully establishing co-operative bacon factories with their ever-increasing trade. The valuable report on "Co-operative Associations and rural conditions in Denmark," submitted by the members of this deputation, unanimously attributed the whole of the success of the Danish farmers to co-operation. So strongly impressed were the members of the deputation and the officials of the Irish Department of Agriculture by their investigations, that steps were immediately taken to organise the agricultural industry of Ireland on the same lines, with the result that Ireland has, in its turn, also forged ahead. The growth of co-operative bacon curing in Denmark, from 1883, when it practically started, to 1902, was stated by the deputation to be as follows :—

	No. of Factories.	No of Pigs killed.	Value.	Average Price per Pig.
1888 ...	1 ...	23,407 ...	£57,000 ...	£2 9s. 0d.
1902 ...	27 ...	777,232 ...	£2,500,000 ...	£3 4s. 6d.

It will thus be seen, as regards that one industry alone, what an enormous advance was brought about by co-operation, and an interesting fact to be noticed is, that, whilst the number of pigs were dealt with had so enormously increased, yet the average price per pig had risen from £2 9s. to £3 4s. 6d. The increase in average price per pig was progressive each year.

The first co-operative dairy was opened in West Jutland, in 1882, and in 1902 there were no fewer than 1,050 of such dairies in Denmark, with 148,000 members, 750,000 cows out of a total 1,067,000 milch cows in the country. In 1902 Denmark exported, mainly to Great Britain, 135,000,000 pounds of butter, and the amount invested in the erection and the equipment of the dairies was over £1,500,000. One fact about this enormous development in Denmark to be specially noted, as regards the conditions in Natal, is that *the initiative has always come from the people themselves.* The tendency in Denmark has been not merely to increase the annual output, but to enhance the quality of the product itself—so much is this the case that the farmers of Denmark voluntarily submit to such severe restrictions imposed by their own co-operative societies, as would infallibly kill our dairy industry were similar restrictions applied in Natal. Rules are laid down by the Co-operative Creameries, binding the owners of cows to deliver to the Creamery, for a period of ten years, the milk of the whole number of milch cows, which at all times the farmers may have in their own possession—with the exception, however, of milk required for house purposes, as well for their own as for other households in their own districts. Should any member desire to withdraw before the termination of the first ten years from the Creamery, he has to pay a fine for every cow so withdrawn. The milk has to be delivered in a clean and unadulterated state, without any disagreeable taste. Members are bound to keep the milk cool when it is not called for immediately after milking has taken place. Two milkings are not allowed to be mixed. The milk of a cow must not be delivered at the Creamery until three days after calving. The milk of a cow suffering from any disease, can only be delivered when accompanied by the certificate of a Veterinary Surgeon. In the event of an outbreak of a contagious disease, milk must not be delivered from the farm so affected. Milk which is sour, adulterated or which arrives at the Creamery in cans not thoroughly clean, is rejected. Rules are laid down regarding how much food each cow is to receive during the winter, and, in case any particular food interferes with the quality of the butter at the Creamery, the Committee have the right to demand that such feeding stuff shall be discontinued. Notwithstanding these and other severe restrictions, the most interesting feature in every co-operative concern in Denmark, is the extraordinary fidelity invariably observed towards their own institutions by the people who participate in them.

Speaking generally, the greatest degree of success in co-operation in any country has been obtained where the associations have been started on a very small scale in rural districts, to meet local or even strictly parochial conditions, and, while maintaining their individual entity, have afterwards combined with other similar bodies to form districts, county, or even national federations, for the attainment of any common advantage. Over and over again, in the investigations made by Mr. Pratt, offers the fact that the movement of co-operation in various countries, which has assumed such wide-spread operations and under so many different forms, had its actual rise mostly in the starting, by isolated individuals, of small associations for the combined purchase of agricultural necessaries, scope of action being subsequently widened, alike by the taking up of other objects, and by means of groups and feder-

ations. Monsieur L'Abbé Bergier, at an agricultural conference held at Nivelles, in 1899, stated that "in the founding of agricultural associations, it is prudent to begin with parochial societies which will federate with one another when there is a certain number of them." Wherever agricultural societies have been gradually evolved in what might be called this natural manner, they have met with success; but, where endeavours have been made to foist large organisations upon agricultural communities, such endeavours have seldom met with more than temporary success. As an instance of this may be mentioned the British Produce Supply Association, which was started in 1896, by Lord Winchelsea, to do away with the middleman, and sell the produce of the British farmers direct to the London consumers. One of the principal causes of failure of this Supply Association was that very soon after its inaguration, it was found that the farmers would not forward regular consignments of their produce to headquarters, and that those which were sent in represented only too often their second and third rate qualities—their best having gone to the ordinary commission agents or dealers. Commenting on the failure of this Association, Mr. Pratt states that *it was an ambitious scheme, and one which should have represented the climax rather than the commencement of an agricultural organization.* Many of the most powerful agricultural bodies on the Continent have found that, while co-operation for the purpose of production is eminently practical, co-operation solely for the purpose of sale is a very difficult problem, and one fenced with difficulties.

Denmark is not the only country where the people voluntarily submit to the restrictions placed upon them by their own co-operative societies. In North Holland, the market gardeners have formed themselves into co-operative societies, which are also conducted along extremely practical lines. The goods of the members, before being offered for sale, are inspected by officers, appointed by the co-operative societies for the purpose, and any that are regarded as below the required standard are rejected, while those that are passed are labelled with the registered trade mark of the society. It is also seen that the consignments are of the stated quantity, and that they have been properly packed. The produce thus approved of, is offered for sale, at the society's mart, the auctioneer being generally the president of the local society or banch.

As an example of what might be done by the farmers in Natal with their meali crops, I may instance the case, stated by Mr. Pratt, of the farmers in Hungary. Experience had taught them that, so long as each relied on his own individual powers in the selling of his corn, he laboured under certain distinct disadvantages. He was specially at the mercy of any "ring" of buyers which might be formed, for they knew that, even if he could afford to keep back his crop for a more favourable market, it was practically impossible for a farmer, located in districts away from the railway, to hold his crop until the winter, because he would not then be able to get it to the railway station owing to the state of the roads. To meet the position thus created, the farmers in a number of districts formed co-operative organizations for the construction of elevators on sidings near the more conveniently situated railway stations, and to these elevators the farmers sent their corn to be stored, the individual lots losing their identity, but representing, on the whole, analogous qualities of grain. By means of these elevators, the available supplies could be kept for a length of time. Not only was the previous difficulty of getting them to the railway station in the winter obviated, but the ultimate collective sale meant the transport of the corn on the railway in bulk, thus effecting a considerable economy as compared with what would have been paid had each farmer sent off his own particular lot as a separate consignment. Financial arrangements were made at the same time by which the farmers obtained advances from the credit banks on the corns they sent to the elevator, and, with these advances in hand, they were able to

wait for the balance until such time as the sale could be effected to their advantage. So well has this further development in the way of agricultural combination answered in Hungary, that a central organization is being projected for the express purpose of encouraging and facilitating the construction of co-operative corn elevators in all the corn growing districts of the country.

An excellent example of what can be done in a small way is afforded by the Muskham (Notts.) Co-operative Agricultural Society. This village organization was started in 1899, with seven members and a secretary, and several months elapsed before the membership was increased. The shares were 5s. each, 1s. 3d. being called up. Just prior to the harvest of 1899, the society resolved to purchase a reaper and a binder at a cost of £32 (although their paid up capital was only £15), and the members obtained an advance from the local bank on their giving a guarantee to hold themselves collectively and individually responsible for the repayment. A scale of charges for using the machine was drawn up, and the receipts have since then been sufficient to clear off the loan, so that the machine now belongs to the society, and the further income derived from it, over and above the wear and tare, represents so much profit.

Once co-operation is started in this small way, the advantages of it become so clearly realised that it soon spreads and is utilised for other purposes. Mr. Montgomery, of the Department of Agriculture and Technical Instruction for Ireland, mentions the case of a parish of 1,600 inhabitants in Hanover, which can boast of five flourishing co-operative societies, a savings and credit bank, an agricultural supply society, a dairy society, as egg society, a milling society, and a society for the sale of cattle.

It is a cardinal rule with all co-operative societies, in whatever country they may be situated, that politics and religion are barred. As a matter of fact, these co-operative societies have been the means of bringing into friendly relations members of opposite political factions and of various religions, between whom previously feud and enmity had prevailed. In Belgium and in Italy these societies have been actively propagated and fostered by the Roman Catholic Clergy as an antidote—and a very successful antidote—to socialism.

Co-operation can be used for innumerable purposes, among which are the purchase of manures, the purchase of steam threshers, the sale of cattle, the sale of corn, cattle breeding, horse breeding, egg and poultry, manufacture of jam, steam ploughs, cultivation and sale of fruit, milling, improvement of cart horses, allotments and small holdings, bee keeping, flax, cheese, dairy and butter making industries, purchase of seeds, purchase of agricultural implements; and many societies have started merely as a co-operation to forward goods in bulk so as to get the advantage of truck load rates, and co-operation to purchase goods at one and the same time with the same object.

The movement started in Ireland with Sir Horace Plunkett, in 1899, but it was tremendously up-hill work, and he had to address fifty meetings before he got the first co-operative dairy started, and it was not until another twelve months had passed that he saw the second. The success gradually became more assured, so that, in 1891, the creameries and co-operative societies numbered 17, until, in 1894, the Irish Agricultural Organization Society was formed with a view of controlling the whole movement, supplying all the necessary information required, and fostering it in every possible way. The year following the formation of this society, the number of creameries and societies increased to 67.

The movement in England was of a later date than that in Ireland, and it was not until 1901, seven years after the Irish Society had been formed, that the British Agricultural Organization Society came into existence as a result of, and to further the establishment of co-operative societies in England.

Throughout the whole of this co-operative movement, whether in Great Britain or on the Continent, the importance of the small holder is prominently brought out. He it is who is the main support of such societies and, in fact, the main producer of the stuff dealt with by co-operative societies. The deputation already referred to, which visited Denmark, stated that, as an example in small farming a visit was paid to a prize farm of 10 acres, which maintained from 3 to 4 cows, and which in 1902 brought a sum of 810Kr. for milk (note, 810Kr.—£44 11s.). This small farm was worked with one horse, and the arrangement of the offices and the general surroundings of the little homestead reflected the greatest credit upon the peasant occupier, who was, indeed, exceedingly proud of his possessions. On a third farm, visited by the deputation, of 75 acres, 14 milch cows were kept, and four horses. There were two sows with two litters; and about 30 pigs were annually sold off the farm. The average return for milk was 240 Kr. (£13 4s.) without taking into account the milk used in the household and a certain quantity which had been sold to farm labourers in the locality.

Mr. Pratt makes a strong point that each local co-operative society must fulfil its own particular purpose according to the special needs of the locality where it exists, but that collective purchase has, nevertheless, been found to represent the most practical and the most hopeful means of making a start. Collective sale is a higher standard which will be duly attained when the education of the farmers in matters co-operative has been sufficiently advanced.

The more prudent advocates of agricultural combination have been averse to the mixing up of domestic and business considerations, and have advocated that the co-operative purchase of fertilisers and implements for the fields should be kept distinct from the co-operative purchase of flour and sugar for the household. Although at first there is likely to be opposition on the part of the storekeepers to the formation of agricultural societies for the purchase of agricultural necessaries, yet, when they see that, although as a consequence of the formation of such societies, they are not able to obtain so much profit per article, by the same means farmers are able to purchase larger quantities, their opposition will cease as it has done in other countries—but the middleman, pure and simple, must go. By dealing direct in large orders the merchants have certain expenses such as travellers' commission, advertising, etc., and the risk of bad debts, saved; and can, therefore, quote more reasonable terms.

The nucleus of an agricultural society is already in existence in each district of Natal, in the shape of the local farmers' association or club; any information which such farmers' association or club may require previous to the formation of a small co-operative society, can be obtained on application to the Department of Agriculture, Maritzburg; and, should the co-operation decided upon by such farmers' association or club take a form, or develop into an undertaking, in which financial assistance, in the way of loan for capital purposes, is required, the Agricultural Development Act, 1904, empowers the Government, through the medium of the Land Board, to advance whatever money may be required. The sections bearing upon loans to assist agriculturists in the establishment of co-operation concerns are as follows:—

56. The Board may, with the approval of the Governor in Council, assist agriculturists in the establishment of factories or the like for the purpose of the manufacture of dairy and farming produce, such as butter, cheese, and tobacco, or the packing and the preserving of fruit, or any other factories for the purpose of the better utilisation or marketing of raw produce.

57. No scheme for any such undertaking shall be approved unless it is to be established and carried on by an association in the nature of what

is known as a co-operative association, or until the constitution and articles of such association have been submitted to the Board and approved by them.

58. The regulations under this Act may prescribe the conditions necessary to be complied with before any association can receive the approval of the Board, whether in respect of its formation, membership, or liabilities, the distribution of profits, or any other matters whatsoever relative to its constitution.

59. The assistance to be given by Government shall be by way of a contribution towards the capital outlay, and such contributions shall be made upon such terms as to payment, repayment and otherwise as to the Board shall seem proper.

Such a locality as that of Weenen, where—for Natal—a comparatively large number of farmers are to be found within a comparatively small area, lends itself favourably to the formation of a co-operative association ; and, should the residents of that or any other district bestir themselves, the Land Board will be only too willing to consider the question of financial assistance.

And now to answer the question with which this article set out, " What is the best form of agricultural co-operation for Natal ? " Evidently, the answer in brief is, "That which arises spontaneously within any particular district to meet the particular needs of those co-operating."

As to " how to co-operate," the first thing to learn is what *not* to do. Do not rely on, or wait for, the Government to start a co-operative association for you, but start one yourselves, no matter on how modest a scale it may be—in fact, the more unpretentious its aims, the more likely it will be to succeed and to give you confidence subsequently to embark on something more ambitious. Do not wait until you have got all—or nearly all—those in your district to combine ; but make a start as soon as you have got your two or three gathered together, confident that those who are holding back will join you, as soon as they see something is really being done, in order not to be left out in the cold. Do not at first undertake anything which cannot easily be managed by yourselves, and over which you cannot excercise constant supervision—when you have felt your feet and learnt to walk with confidence in the path of co-operation, you will soon be able to venture upon further and more hazardous expeditions.

And, as to " what to undertake," I would recommend first of all,

(*a*) Co-operation to secure that consignments cf produce or live stock sent away from any district reach the railway station at the same time, so as to make up combined truck loads, and hence reap the advantage of truck load rates.

(*b*) Co-operation to ensure that goods or live stock purchased elsewhere by the farmers of a given district be delivered at the same time, so as to secure truck load rates.

(*c*) Co-operation to purchase, jointly, manures, seeds, or agricultural implements, so as to deal direct with the manufacturers and get the benefit of wholesale prices. (This is a form of co-operation which has already been in existence in Natal.)

(*d*) Co-operation for the local collection and sale of mealies to Government in connection with Government contracts. (At present it frequently happens that no local tenders are received by the Government for the supply of mealies in mealie growing districts, and that Government, consequently, has to accept the tender of a middleman

in Maritzburg, which means that the commission of the middleman, rail carriage from district to Maritzburg and back again, have to be added to cost of mealies. A combination of local growers could thus easily tender at a rate more remunerative to themselves than that received from the middleman, and yet at a figure which would place the middleman out of the running.)

(*e*) Co-operation for the storage of mealies in tanks or granaries so as not to be forced to sell on an unfavourable market.

(*f*) Co-operation, in dairying districts, for the establishment of dairy factories, or—where the immediate formation of such a factory is scarcely justifiably or too risky—for the establishment of temporary cream separating stations from which the cream so separated can be sold to one of the dairy factories.

(*g*) Co-operation, in fruit growing centres, for the collecting and forwarding simultaneously, in uniform packages, of fruit so as to reduce cost of transit; also, for the formation of fruit canning and jam factories.

(*h*) Co-operation, in poultry centres, for the collecting, grading, and stimultaneous forwarding of eggs in one large crate instead of, as at present, each farmer sending in his own small consignment.

(*i*) Co-operation for the formation of ham and bacon curing establishments.

Detailed information in regard to any of these suggested forms of co-operation will, as previously stated, be readily supplied on application to the Department of Agriculture, Maritzburg.—*Department of Agriculture, Natal, Bulletin VIII.*

THE EMIGRATION OF LABOUR FROM MEXICO.

One must have lived on the northern frontier of the country for long years and have seen the interminable exodus of poor people who fill our trains, and who are constantly going on foot along the railway tracks and roadways toward the north to appreciate the importance of this imigration which should have given us much concern. One must have voyaged in the trains and have been in contact with these people to form an idea of the causes of this phenomenon and to realise that the people have made great errors in judging them. To all our frontier villages and towns there are arriving thousands of poor men who have abandoned ranches and villages where they lived to go to work in the United States. They arrive in groups of five, ten or more persons; and the first thing they do is to select clothing of grey or brown duck, thus abandoning their traditional apparel, that they may thus more easily deceive, in collusion with the labour agents who have engaged them, the restrictive regulations of the emigration laws of the neighbouring nation.

To lie to the emigration agents or inspectors, and say that they know some house in some city in the United States, that they have been in towns in Arizona or New Mexico, that they have worked on such and such railways, etc., is a lesson that they readily learn enough; and with duck clothing, hob-nailed shoes, a few dollars in their pockets, and the help of the labour agents, who work for the end and are not particular about the means, the business is carried through, and they enter for the first time into the neighbouring nation in search of work. In speaking of the desires of European and Asiatic emigrants to enter the United States, a Mexican has called this the first stroke of good fortune. For our emigrants it is also the first stroke of good fortune.

This emigration is not a recent thing, and, according to the statistics of our country, it is measured by thousands. This is why places in the interior have been decimated and haciendas completely abandoned, which were once sources of great wealth, now they are idle because there are no laborers to work them.

There exists on the borders of the republic an imaginary line marked by imaginary terrestial parallels, or by the bed of a stream, dry the greater part of the year, a line which is more easily noted on the map because it is drawn in colors, and which enthographically separates two distinct peoples. But it is no great obstacle for the man who can work and is a native of Mexico.

To the south is a nation which requires work, which is seeking capital and needs colonists; a nation which is progressing vigourously, though not phenomenally, as the yellow journal say, a people which is passing through an evolutionary stage in its schools, its government and its industries, which will some day be a rich people, but which is still poor; a nation which does not inquire where its emigrants come from, for it needs laborers, let the class be what it may.

To the north is a wonderful nation, rich, powerful, plethoric, with capital, industry and energy, and which is not content to contain itself with its own frontiers, a nation which has been receiving European immigration for many years, and which may now select her immigrants, covering a poll tax or prohibiting entrance in a definitive manner. Notwithstanding these conditions, men are contiually crossing this line, and are leaving the country which requires labourers and is bidding for colonists, and they are going to the country which prevents their entry and collects a tax on all those entering, instead of paying for them as the former has done. This is done apparently, in opposition to all the laws of physical science. And yet it has its explanation, which is easily understood if we throw beyond us all prejudices.

This current has continued to flow unnoticed by the people of the interior until the depopulation has made itself felt through the alarming proportion it has taken; for the simple reason that they have not thought of the facts that there are mines in Arizona and Colorado, ranches in California, and railroads in construction throughout the states to the north which are being built exclusively by Mexican laborers who have arrived recently.

Therefore it is not a question of building up the city population at the expense of the rural, as is the case in the United States and Europe. This is felt to some extent in Mexico, where the manufactures of the city are built up at the expense of the country, and the mines pay $1·50 to the peons who gained 50 cents on the ranch, though often, when the price of provisions taken into account at the mines, he gains no more than he did at home.

The pleasures and comforts of the city, too, attract the laborer from the hacienda, and this added to the higher wages he receives in the cities, causes many to flock there. But we are feeling only what other nations have felt before us and are now feeling.

In all parts of the country, as soon as a railway approaches, at once the scarcity of laborers begins to be felt, on account of the call for them for construction work, and as soon as the road is in running order the communication which it makes with other parts of the country and with outside nations causes the laborers to leave the fields. The discovery of mines also helps to take away the laborers from agricultural occupations.

These are some of the causes of rural depopulation. But there are still others. There is the attraction of the United States. And if the first helps our mining industry at the expense of the rural districts, the second brings with it an evil which has no recompense and redounds only to the benefit of the foreign nation.

I have heard sensible persons say that the peon goes to the United States

because he is shiftless and likes to move about; and I have known hacendados who advocated punishing the laborers who were so bold as to leave the hacienda, by preventing them returning. But those who think that any such treatment of the peon will benefit him are greatly mistaken. Others believe that every Mexican laborer who goes to the United States is maltreated by the gang bosses and capitalists, and is handled like a slave. But this is a great mistake.

Our people may be ignorant, lazy, timid, vicious, uncultured, anything, you will, but they are not ungrateful, nor lack in patriotism, or unloving toward their families and homes. Therefore, in going to the United States, they are but giving proofs of advancement and of showing those very ambitions which every one denies that they possess.

Why not recognize the truth? The Mexican peon in the United States does not there occupy a lowly place in the work market, notwithstanding the fact that he gains there the lowest wages and is engaged to do the heaviest work. He is sought after and has abundance of offers for his services.

The railroads give our laborers transportation free upon their giving their word that they will work for the company. They do not require to beg to obtain their passage. All they require to do is to go and work a few days on certain sections and get free passage.

The Mexican peon also is looked upon favourably in the United States, especially in railroad work, for the reason that he has no higher aspirations, and so is not likely to quit his job to hunt for a better one. And urged by the necessity of the case the peon works better in the United States under American masters than he does with us. And as he works cheaper even than the Chinese, he is therefore a very desirable laborer in the United States.

The Mexican peon in the United States occupies the worst position as to wages, kinds of work and the hardships of not knowing the language and the differences of customs of the two nations. And yet he is going there by the thousands,

And what is the reason? It is simple. This bad position which he occupies there is better than he finds at home. It is a sad thing to say so; yet we must, if we are to find the remedy for it.

The United States is a school for our peons. Those who go there soon learn to clothe themselves better and use shoes and the clothing of the American laborer. They eat better food, using meats, potatoes and bread. And of necessity they have to forget chile, liquor and tobacco, or are compelled to use them in moderation either because they cannot obtain them or because they are very dear there. This means the suppression of three disease-giving elements, and consequently leaves the peon in a condition to work better than he does at home.

His ideas broaden and he learns that the world is a very big place, and that there are people who will pay him better for his work than he is paid at home, and that these people take better care of him and are anxious to have him.

He learns that it is not necessary to live in the land of his fathers where his labor has ever been badly paid, and he has always been in debt to the tienda; where he has never known what good food is; where no one has ever cared for him.

And yet these peons cannot forget their own little home spot in Mexico, and as soon as they have saved a little they return well clothed to their "tierra," to see their people, eat tortillas and beans and chile, and to bring back some money to their families; and they throw their money around and get drunk to the envy of all who have remained at home. And the result is, that the more adventurous of their brothers, relatives and friends go with them to hunt fortunes in the United States. All this helps to weaken our national forces.—*Louisiana Planter.*

SCHOOL GARDENS AND THEIR WORK IN THE UNITED STATES.

(From the Transactions of the Massachusettes' Horticultural Society, 1905, Part II.)

The year 1905 marks a turning point in the activities of this committee, it being the last year that prizes will be awarded for Children's Herbariums and Native plants, and it has been most successful. In the year to come the committee will be known as the Committee on Children's Gardens, and all our efforts will be directed to the encouragement of gardening among children, which is more directly in line with the objects of the Society.

During the year we offered prizes for school gardens, children's home gardens, children's herbariums, and native plants. The work now dropped is that connected with the last two, and we think that we can carry out the purposes of the Society better by this change. While we regret being obliged to make the change, we are very glad that the Trustees concur with us in the matter. Early in the year, very soon after our prize circular was distributed, a letter was printed in the Boston Transcript criticising our offering prizes for children's herbariums, the writer complaining that we were encouraging the destruction of native plants. It was thought wise to call together the members of the committee and to ask several members of the Society for the Protection of Native Plants and others interested, to meet with us to discuss the subject. While this gathering was not largely attended it resulted in a decision that we were not encouraging the destruction but rather helping the protection of native plants, and we made no change in our efforts. As it has now been decided to drop this work as too botanical for our Society, nothing further need be said.

On looking over the results already accomplished we felt, that, while we had fostered the school garden movement from the very beginning, we were not having entries from all the gardens in the state, and that we were not giving encouragement to more than a few of the older gardens. In order to bring our work before the public four articles were written, one on each phase of the work, and published in the Boston Transcript. We also sent out a large number of our circulars to superintendents of schools and others likely to be interested. The results of this canvas were most satisfactory as seen by the increased interest in our work and in the number of entries for prizes.

In order to become better acquainted with the children's garden movement, and that we might carry on our work successfully, your chairman visited nearly all the gardens entered for prizes. In this way it was possible for him to better understand the existing conditions as well as to talk with the garden worker. A number of other gardens were also visited; among these were the School of Horticulture at Hartford, Conn., and the School Gardens of Hartford and Amherst, Mass. The great lesson learned was that children's gardens are successfully carried on when under the leadership of an experienced garden director or teacher. No matter how enthusiastically the work is undertaken, without a proper understanding of gardening it is usually a failure, and the movement likely to be given up. In all cases during these visits your chairman was cordially welcomed, and usually a conference resulted which was helpful to both. There is a crying need for an institution in this state similar to that at Hartford, Conn., where school garden work can be taught, and it is hoped that such an institution will be started in this vicinity at an early date.

Children's Garden Conference.

With the hope of bringing together those interested in the movement, a conference was planned in connection with our Children's Herbarium Exhibition in December, and it proved a great success. Invitations were sent out to a number

of prominent children's garden workers, asking them to come and take part in the exercises. It was very gratifying to find that these invitations were heartily accepted, and the success of the conference was assured. A printed announcement was sent out two weeks in advance, and suitable reading notices were kindly printed by the leading papers. The program included an address of welcome, the announcement of awards for school and home gardens, and seven ten-minute addresses covering various phases of the work. Ample opportunity for discussion followed. The Conference was held at Horticultural Hall, Saturday, December 2nd, at 10 o'clock

Your chairman called attention to the fact that our Society gave encouragement and financial assistance to the first school garden in the country, which was started in Roxbury as an experiment. We may therefore consider ourselves leaders in the movement. He briefly reviewed the present conditions, told of the aims of the Committee, and asked for the co-operation of all interested in order that the work might be carried on to the best advantage. After announcing the awards he introduced the first speaker, Miss Esther F. Hallowell. She spoke in place of Miss Annie Withington who was unfortunately obliged to be out of town. Other addresses followed, and nearly every side of the children's garden movement was discussed. As many valuable points were brought out the speakers were asked to furnish abstracts of their addresses, and these are given in connection with this report.

School Gardens.

There were twelve entries for prizes for school gardens this year, and all but two sent in reports. This is a gain of nine over last year and the largest number ever entered in one year. The season opened up dry and some of the gardens were very discouraging in the beginning, but picked up later, and in most cases gave satisfactory returns.

It is well to call your attention to the classes of school gardens which we find. One connected with the public schools and usually in a dormant and weedy condition during the summer, to be revived again with the opening of the school in September. Another, not connected with a regular school, which begins with the opening of spring, or as early as possible without interfering with the regular school work of the children and continuing through the summer until frost. It is very difficult to manage in a public school a garden which will last through the summer, but in some cases, as at Fairhaven, this is most successfully accomplished. In other places the children who stay at home during the summer work in their gardens, while those who go away are obliged to give them up. In large cities the summer school garden is very important and never lacks children; in many places a long waiting list is kept and any vacancies are readily filled. Where the children go away they often have a home garden at their summer home.

The reports of the gardens sent in were very satisfactory, and it was difficult to award the prizes. After careful deliberation it was decided to give besides the prizes two honorable mentions. There are six prizes offered next year, three for the established or large gardens and three for new and small gardens. The classification here is rather indefinite, but it is our desire to give small and new gardens all the encouragement possible. Whatever we do we are very anxious to put school gardens on a permanent basis, and it is with these ideas in mind that we are working. The reports of the directors of the prize gardens will be found further on.

Children's Home Gardens.

During 1904 we offered for the first time three prizes for home gardens, and there were five entries. In making up the list for 1905 great hesitancy was felt the members of the committee as to the advisability of offering more than three

prizes. It was decided, however, to try the experiment, and the number was increased to ten. When the entries were in it was discovered that we had over two hundred, and we found we had made no mistake.

We visited the home gardens as far as possible, and found it was very encouraging to the children to do so. We still feel that the children's home garden movement is a very important one, and that local organisations and parents should encourage the children to have them. We have increased the prizes for 1906 both in number and in amount, and call special attention to the fact that girls receive the same prizes as the boys.

The two principal centres for home gardens this year were at Ayer and Reading. Unfortunately the gardens at Ayer were not as well kept up as might be desired, though some were very nice; here again the dry weather discouraged the young gardeners. In Reading the home gardens are encouraged by the Woman's Club, and some very prettily gotten up reports were sent in. A larger number entered than were reports received which brings out an important point, namely, that a local organization can sift out the best reports from those entered for our prizes and thus save us a good deal of trouble; it also helps as they are often better judges of the gardens. We want to see a great increase in this work the coming year, and feel that our prizes are sufficiently large to attract competitors. It is impossible for the committee to visit a very large number of home gardens, but if those which are the best in any locality are selected, the chances of visiting them increase and in this way the children are encouraged.

Several letters from home garden prize winners follow.

CHILDREN'S HERBARIUMS.

Owing to the great number of herbarium sheets exhibited during 1904, it was necessary to limit the number acceptable from any one child. As a result of this better sheets were brought in, though fewer in number. While in 1904 there were 2,316 specimens received but 1,815 were awarded prizes. This year only 989 were sent and 780 accepted. Of the 201 rejected 148 were improperly labelled, so that had our rules been carried out by the competitors comparatively few would have been rejected. We were also enabled to vary the amount of our awards according to the value of the sheets which was impossible last year owing to the number of sheets accepted and the lack of funds.

The exhibition this year was held in the large hall, on account of the Children's Garden Conference in the lecture hall on Saturday morning. It occupied two-thirds of the hall and was well staged. An exhibit of evergreens from the Chrysanthemum Show added greatly to the appearance of the hall. Prize cards were put on the exhibits at the opening on Friday morning, and we believe that the awards were in every way satisfactory to the children.

Photographs from school and home gardens, collections of insects, and garden reports we also put on the tables, making altogether the most interesting exhibition ever held by our committee. We are very glad that our last exhibition of children's herbariums proved so successful, and hope that our children's garden efforts will produce as many horticulturists as the herbarium work did botanists.

NATIVE PLANTS.

The exhibits of native plants, for no apparent reason, were fewer during the year than last year. The exhibits themselves, however, were good and in every way up to the standard, in some cases even better. It was recommended by your chairman that the awarding of prizes for native plants be taken away from the work of the committee, as it is so different from the children's garden work that the committee became divided in interest, those caring for native plants not being

interested as deeply in the children's garden movement. It will probably be remembered that the work of awarding prizes for native plants has been at various times part of the work of our committee and at other times under the jurisdiction of a special committee. Your chairman recommended that a new committee be appointed to take charge of the native plant exhibitions. It was decided, however, by the Trustees, that the exhibits of native plants were of a botanical nature and should not be continued by the Society. While this is sincerely regretted in some ways, it is perhaps for the best, and we are very glad to be relieved of the work.

Children's Exhibitions.

Members of the committee visited the two children's gardens exhibitions of the Worcester County Horticultural Society at Worcester during the past summer with a view of holding similar exhibitions in Boston. The exhibits were successful in every way, and we were glad of the opportunity of studying the methods employed. Due credit should be given to Secretary Hixon of the Worcester Society for his efforts in this work.

Carrying out this idea we are offering prizes in our new circular for 1906, and hope to have two successful exhibitions, one in June and one in September.

Looking Forward.

Under the new name of Committee on Children's Gardens we have a definite line of work, and with an increased appropriation we expect to place our Society at the head of the movement in this state.

Our goal is reached when every school in Massachusetts has a garden and every child has a home garden. We believe that if this goal is ever reached the results in happier and better children and in improved home surroundings will amply repay all our efforts. We ask the hearty co-operation of all members of the Society, and thank the trustees for their attention to our requests. The field is broad, the results inspiring, and our onward movement is dependent on our energy and the money at our command. May both increase in the year to come.

Abstracts of addresses made at the Children's Garden Conference, held at Horticultural Hall, Boston, December 2nd, 1905.

SCHOOL GARDEN WORK IN BOSTON SCHOOLS.

By Miss Esther F. Hallowell, Boston School Garden Committee.

The Rice School Garden on Dartmouth Street, which was started in connection with the Boston Normal School in the Spring of 1901, may be said to be the pioneer in the attempt to establish garden work in the congested districts of any large city. A vacant lot near the schoolhouse was secured and the ground dug up and fertilized by many loads of street sweepings. The lot was then divided into individual beds, 8 feet by 4 feet, which were given to children of the seventh grade. Seeds were planted and watered by them, and soon the heretofore barren ground began to be spotted with green. Support for this garden both active and material was given by a committee of the South End House. Later in the year the Twentieth Century Club of Boston helped. The following fall there was introduced into the Normal School an elective science course with practical work in the Rice Garden.

During the summer of 1901 the Civic League Garden was established on the Columbus Avenue playground. Beds were allotted to the children in the order of application. In the spring of 1903, with these two gardens as examples, seven new ones were established by the Women's Auxiliary of the American Park and Outdoor Art Association. Later these committees merged into one School Garden Committee.

This committee now has the supervision of nine school gardens. Five of these gardens are confined to very limited spaces in the school yards, and therefore the separate beds are much smaller than they should be for the best work. But in these crowded districts we are thankful for every inch of ground given us. The schools above referred to are the Lyman and James Otis of East Boston, the Hancock in the North End, the Winthrop and the Martin in the South End.

The Wells (girls) and Phillips (boys) Schools, of the West End, are situated in one of the most congested quarters of the city. The school yards are large enough only for the children to stand during their recess periods, crowded together like penned up animals. To enable these children to "farm" the Boston Park Commission has been most obliging in giving two strips of land on the water front of the Charlesbank Park which have been converted into 118 beds. The Park Commission placed fences around the strips and plows up and fertilizes the ground each spring before the children go out to make preparations for planting.

The problems of space and fertilizing which must be faced and overcome by the city gardeners practically disappear when we go to the suburbs. The two suburban schools, the Washington Allston in Allston, and the Blackington in East Boston are fortunate in having enough land to enable each child to possess a larger plot and therefore to accomplish more satisfactory work. The Washington Allston school has several fruit trees on its premises.

In the Boston public school curriculum two hours a week are set aside for nature work. Through this channel, with the interest of the school authorities and the co-operation of the masters and teachers, the garden work has been introduced. It is one of the great objects of the committee to have the garden work bound to the school and made as important a part of a girl's or boy's school training as the manual work. To accomplish this object with profit to the children correlation of garden work with school work is essential; for by this correlation not only will the garden become more lasting and valuable, but the other school lessons will be made alive by the contact every child had with real good earth and real live plants. If the garden lessons could be continued through the school months the children's interest in the outdoor work would be kept awake during that period, when their gardens are sleeping under the snow of our New England winters. There is plenty of material for these lessons.

In September the new class, preferably seventh grade, is taken out to examine the condition of the plants, the seeds, and the weeds in the garden after a summer's cultivation. In October and November the garden is cleared, the shrubs are pruned, the ground is dug and fertilized, perennials and bulbs are planted, and the garden covered for the winter.

Planting of bulbs in the school rooms is done now also. In connection with the fall work the children are taken to the fruit and flower exhibitions in the city, where the examples they see give unimagined pleasure and arouse great interest in "growing things." During the winter months of December and January lessons on the soil and experiments in germination go far to prepare the children's understanding of what they must do and see when the outdoor work begins. In February seeds are planted in window boxes, so that the small tomatoes and cabbages will be ready to set out as soon as the weather will permit. With March come the catalogues, the garden plans, the buying of seed, etc. April, May, and June present more work than can well be done in the allotted two hours a week. When school closes in June many of the children for one reason or another are unable to attend to their beds. But as many as are able continue to appear at stated hours to continue the work and the vacant places are filled by other children. A part of

the vacation work—or pleasure—are the excursions to the market gardens of Arlington where the children are enabled to see on a large scale what they have already seen on a tiny scale in their little city plots. The work done in the vacation months is in the entire charge of a voluntary committee in co-operation with the school authorities. There has been an attempt to co-operate with the vacation schools.

If a child has attended school regularly, and has been able to care for his garden in the summer, he has seen performed under his eyes a complete cycle in the vegetable life. Add to this the correlation with his other school studies, and the garden becomes a real part, and a valuable part not only of his life but of the life of the world.

In his arithmetic he can find the area of his own garden instead of an imaginary field; from his window box he can study a right angle; in his manual training class he makes the window box, the markers, and sometimes even the tools; in his geography he learns in what part of the country is grown the hemp, flax, and grains, specimens of which he sees in his own plot; in his drawing class he draws a flower or seed from his own garden instead of one brought by the teacher; in the cooking class the girl cooks her own vegetables; in the language class the boys and girls write letters to the seedmen for catalogues or to the agricultural department for seeds, and keep diaries of what goes on in the garden. Thus the garden and all pertaining to it mean something. So many are its advantages that it seems to demand a place in every school.

The necessary money for the support of the gardens was supplied in the beginning by a voluntary committee. More help has come each year from the city, and ultimately the whole responsibility will rest upon the city.

I have spoken somewhat of the educational value of this garden work. I want to say just a word about the economic value. Boston is so situated that its suburbs are near at hand and very accessible; that is, Boston has special facilities for an outward movement. It will therefore be of the greatest service to the city if, by teaching the children to be interested in the cultivation of the soil, the congested districts be relieved.

SCHOOL GARDENS AS A PREPARATION FOR COLLEGE.

(By F. A. WAUGH, *Professor of Horticulture and Landscape Gardening, Massachusetts Agricultural College, Amherst, Mass.*)

The following points were brought out:—

(1) School garden work is many sided and bears on many things. Its value in the preparation for college is only one of these things and not the most important.

(2) Preparation for college is usually considered the business of the secondary schools and academies. However, college preparation consists of everything a student goes through up to the time of college entrance.

(3) Too much thought is sometimes given to preparation for college, especially in the high schools. The high school curricula are sometimes designed as though all high school students would enter college, while as a matter of fact a very small portion of them do.

(4) Nevertheless, preparation for college is confessedly inadequate. There is great complaint that students come to college insufficiently prepared. If this complaint has good foundation when made by the classical colleges, it must be doubly true when made by the technical and agricultural colleges, because high schools and academies do very little in preparing their pupils for agricultural courses.

(5) The work of the school garden to some extent meets this confessed deficiency. It leads more directly towards the work of the technical and agricultural colleges, because it deals with the materials of those courses. At the same time it strengthens the pupils' work in precisely those elements where it is confessed to be weak from the stand point of general training, namely, in initiative and in independence of thinking. This is because the school garden deals with concrete subjects and phenomena instead of with abstract ideas and mere words.

(6) The present speaker confesses to a strong prejudice in favour of that sort of college training which is based upon the sciences rather than upon the classics, so called. He believes the mind secures a better drill in dealing with concrete things and phenomena than in dealing with abstract ideas; that it learns to reason more rapidly and accurately by following from effect back to cause in the study of natural phenomena than in learning by rote some artificial language; and that the training of the judgment which necessarily goes with this practical activity is of paramount importance in all the work of life. From these premises it is very easy to reason that school garden training is valuable to pupils by introducing them to a better sort of college course than they might otherwise elect.

THE SCHOOL GARDEN AS A FACTOR IN VILLAGE IMPROVEMENT.

(By Philip Emerson, *Principal, Cobbet Grammar School, Lynn, Mass.*)

The Massachusetts Commission on Trade Schools has found that children who leave school for work early are of little value to employers, because they lack the initiative and sense of responsibility that were once developed amid the manifold occupations of the farm home. The school garden may aid effectively in securing these qualities. The school should inspire, instruct, and train the children by means of a model school garden; and then the children should apply their knowledge and skill in improving their home grounds and caring for their own gardens there.

When the child of a Russian immigrant laboriously sifts the trodden soil of a tenement back yard, plants corn and flowers in place of stones and tin cans, and guards the growing plants until the corn appears on the table of his proud parents and vines cover the old fence and tumbling out buildings, then something worth-while has been accomplished in his education; he will have developed initiative and a sense of responsibility.

Home gardens, in whose care the children have a stimulus and advice, by means of the school garden, are better than individual gardens at school where assignment and direction are the rule. Independent work at the right point is best. Prizes, perhaps of hardy plants, and due recognition of merit are essential. The school garden should be a centre for civic improvement. Hardy perennial flowering plants may be propagated at school from seeds, divisions, and cuttings, for sale to citizens of a city or town. The children are given training in their care, and a great variety of the best hardy plants may be very cheaply introduced into a community, the school incidentally receiving a considerable revenue from their sale. In the Cobbet Gardens a single hardy chrysanthemum secured in the spring of 1901 has now multiplied to over 250 plants that will be distributed in the spring of 1906. We have dozens of varieties of seedlings in cold frames. A city school garden should carry garden work throughout the year, by means of cold frames, hotbeds, window gardens, mushroom beds in the cellar. and ere long by a school greenhouse. Such intensive garden work is the appropriate training for city conditions where land is valuable and children have time to spare. What school garden development most needs is instruction for teachers. The Massachusetts Agricultural College

should publish leaflets and arrange extension courses for teachers. There should be a practical class in gardening open to teachers in one or more places of eastern Massachusetts. There are failures and much waste in the work now because of the inability of teachers to grow plants with full success.

CHILDREN'S GARDENS FROM FROST TO FROST.

(By Herbert D. Hemenway, *Director, School of Horticulture, Hartford Conn.*)

Three things fix a man's value in the world. His knowledge or what he knows, his ability or what he can do, his character or what he is. The school should help in developing all three, and the school garden is perhaps the most potent factor in developing the man. It increases his knowledge and his ability to do things and develops his character.

The school garden can be correlated with all other things taught in the class-room. It takes away the drudgery of the school life. Children having some outdoor work in the garden, generally, if not always, develop more rapidly mentally as well as physically and morally.

The school gardens at the Hartford School of Horticulture begin for the first year in May; the second year in March; the third year in February; and the fourth and the fifth years in January; and continue until October. The children comes into the class-room, where they receive their notebooks, and write down from dictation or copy from the black board definite directions; then with the instructor and their seeds they pass into the tool room, where they receive their tools, and then into the garden, passing by observation plots of all of our common agricultural and market garden crops, flowers, and fruits.

There are now about five hundred different kinds of things growing at the School of Horticulture; all distinctly labelled with the common English names. While an agricultural failure may not be an educational failure, we should try to have the school gardens succeed, and have results from an agricultural and horticultural standpoint. The moral value of success is very great, and wherever possible the gardens should be conducted right through the summer, so they may never become over-grown with weeds. In this way it will keep the boys occupied, or otherwise they would be on the street learning nothing that was good, and often sowing the seed of future crime. The gardens should begin early, as soon as the frost is out of the ground, the land should be thoroughly prepared, and they should continue right through the summer. We should have the gardens from frost to frost, and the best possible results not only from a horticultural standpoint, but from the development of body and character. It also has a money value. The children learn something of industry and are able to work about the city, and take care of lawns and make themselves useful, thereby increasing the earning power of the family.

SCHOOL GARDEN WORK IN CLEVELAND, OHIO.

(By Miss Louise Klein Miller, *Curator of School Gardens.*)

Miss Miller told of the work which had been done by the Home Gardening Association, in conjunction with the Board of Education, in inaugurating school gardening in Cleveland, and spoke very enthusiastically of the work which had been accomplished and which they expect to do in the future. Cleveland land aspires to be the most beautiful city in the country, and it is expected that the school gardening work will do much to bring about this condition. The following abstract will give a good idea of some phases of the work at the present time:—

The school garden work in Cleveland has now passed far beyond the experimental stage. Up to this year all the time devoted to the garden work has been out of school hours, but it is now planned to make the practical operations of the garden

correlate with other branches of study. The study of soil formation; the relation of heat and moisture to soil; the capillarity of soil; the weather record; the relation of plants and animals to soil are all fundamental to the study of geography.

A child who has laid out his garden with a tape measure, drawn it to scale, and dug the soil, has a definite knowledge of lines, area and volumes. The weighing and measuring of his products and its estimate in money value, give a more vital significance to the study of compound denominate numbers than any artificial device. The opportunity of doing rational nature study in the garden is too apparent to need comment.

The school garden work already accomplished has made Cleveland well and favourably known in all parts of the country where progressive work is appreciated.

The school garden movement was first inaugurated in 1904 by the establishment of four gardens, the expense being assumed jointly by the Home Gardening Association and the Board of Education. This year the Board of Education assumed entire control and established eight gardens in different parts of the city. Owing to the lateness of the season and the unprepared condition of the soil, planting was not begun in some instances until the last of June, and there were many difficulties to overcome. The object is to make the school grounds and gardens radiating centres for civic improvement.

CHILDREN'S GARDEN EXHIBITIONS.

(By Adin A. Hixon, *Worcester, Mass.*)

The first exhibition of children's school gardens that I remember was a little more than 50 years ago. At that time I attended school in Dedham, and Mr. Richardson, afterward editor of the Boston Congregationalist, was the teacher of the school. We had a large school yard of about an acre or an acre and a half, and it was at Mr. Richardson's suggestion that we had a garden. The boys had a large yard to play in with room for a ball ground next to the schoolhouse, and a chestnut and oakgrove on the other side. The girls also had a large yard where there were plenty of shade trees, although these were not too thick to admit the sun in the morning. Their yard was separated from adjoining property by a high board fence, and the teacher suggested that we make a garden alongside of this.

The fence was some 200 feet long, and we made a garden about 100 feet long and four or five feet wide. It was Mr. Richardson's idea that the boys should make the garden, and we set to work filling it with various plants that the children brought from their homes. The boys did all the digging, wheeled away the stones, and brought the dressing in wheel-barrows.

The boys at that school took much pride in this garden, and cared for it faithfully that year and the next. What became of it after that I don't know, as I left school the next year. Not only did the boys take good care of the garden, but they began to take some pride in the school yard, carted away the stones and cleaned it up generally.

While I am a believer in school gardens in certain ways, I do not believe in a society, like the Worcester County Horticultural Society, offering prizes for school gardens until they are endorsed by the school committee, or that that body at least gives its consent to them.

The first school in Worcester to arouse interest among the pupils was the Upsala street school, where Principal Miss Mary C. Henry interested her pupils and teachers to an unusual degree. The teachers at this school gave the pupils of several grades seeds of the bachelor's button, nasturtiums, and petunias, which they were allowed to take home and plant. Just before the close of school

they were requested to bring the products of their gardens to school, and prizes were awarded. Over 250 specimens were brought in and prizes of from 25 to 50 cents were given. The effect of these gardens on the neighbourhood was wonderful, as neighbours became interested in the work of the children, and gradually turned to it themselves, thus changing the whole appearance of the neighbourhood.

Then the Dartmouth street school did something similar in giving out seed to the children. Before the close of school I went up there and talked in three different rooms, where the grades were doubled up. The teachers had the children bring their crops to school, and there was an exhibition in the school corridor, where the flowers and vegetables had been arranged on long tables. I questioned the children to see if they knew the names of the different specimens, and asked how they grew the things. The classes came up one at a time, and we had a sort of an object lesson. Several times after this various exhibits of the best were taken and sent to the Worcester County Horticultural Society's Exhibitions, where they were given prizes of money, which was used in embellishing the school rooms.

The Worcester County Horticultural Society had considered various propositions for encouraging children, but they never amounted to anything until this year, when the society appropriated $50 for two children's exhibitions. A schedule of premiums was made and sent to the various school children and others interested in the work throughout Worcester county, offering $1, 80 cents, 60 cents, 40 cents, and 20 cent premiums for the best collection of vegetables and for the best collection of flowers grown from seed, and prizes for various specimens of vegetables and different kinds of flowers of 50 cents, 40 cents, 30 cents, 20 cents, and 10 cents.

Any child under 14 years of age was entitled to exhibit; the work from the planting to the harvesting of the crop to have been done by the child itself. We had two exhibitions, one in July, and one in August, which resulted in our having 35 exhibitors at one time, and 37 at the other. While nothing had been said regarding gratuities, the committee decided to give a gratuity of 10 cents for every exhibit which did not take a prize. The enthusiasm and interest shown by the children was simply marvellous. One of our most earnest workers was Roger Newton Perry who took our first prize for home gardens. He was one of our largest exhibitors, and did some splendid work.

A feature of the exhibitions was that the children were paid their premiums on the spot. I believe that when you tell a child you'll do something, in doing it, and right away, too. Immediately after the show we paid the children just what we owed them, and every child was happy because everyone got something. I received several letters from some of our young exhibitors afterwards, thanking me for the good time the society had given them.

These exhibitions were so successful and were received so favorably that the society has appropriated double the amount of money to have similar exhibitions next year.

SCHOOL GARDEN NOTES.

(By Frank M. Marsh, *Superintendent of Schools, Fairhaven, Mass.*)

After listening with you to the many interesting phases of the work with children's gardens which have been presented by the speakers this morning, I shall not attempt to add anything new, but I am constrained to ask you for a moment, by way of review, to consider one or two points that may be open to discussion. First, children's gardens should not be begun without careful plans and preparation on the

part of the director. I am firmly convinced after several years' experience that the garden movement, in its most sane aspects, is the best method of nature study that has yet appeared. It should not be taken up in a headlong manner as the result of a bit of temporary enthusiasm which has seized some one who has not counted the cost in labour, thought, and planning necessary to reach an ultimate goal which may be of sufficient worth to pay for the undertaking.

I have now, in mind, a city which of all cities in the state would be greatly improved by the children's garden idea; but in which a hastily conceived and poorly completed attempt at school gardening brought about failure, with the natural result that the whole idea has been sadly discounted and put in the background for many years. Do not injure the cause by starting with only surface knowledge and enthusiasm. Plan wisely and try to realize the highest aim of the movement.

This leads me to criticise some of the aims and purposes set forth in the papers this morning. Some of these aims and purposes have been devised to controvert the claims and criticism of the unthinking who look upon the work as a "fad," which to the public is a horrible but indefinite something. I want to urge one and all not to allow children's gardening in any of its forms to be taken up in such a way as to be looked upon as a "fad." Make it a success and the result will make the doubtful critic sorry that he had not deeper insight into the movement before he passed his hasty judgment.

It is not necessary to go very far afield to find an excuse for the garden idea for children. I fear that a tendency has been too often shown to make the movement too pedagogical; too cut and dried. Do not kill the enthusiasm of the young gardener by making him feel that his garden work is for the sake of helping his arithmetic, his language, or his nature study. It is well to correlate, but do it indirectly or it will, I fear, react unfavourably if we continually try to defend the school garden by illustrating how it may be used for the sake of numbers, language, science, etc. If the idea of childern's gardens has not sufficient merit and value to stand upon its own feet, it had better fall before it climbs any higher.

I like to put the matter the other way, and this, perhaps, is what our friends mean, *i.e.*, to correlate the subjects of science, language, and numbers with gardening in such a way that these subjects may serve as aids to gardening and be used as means or instruments for the sake of the more real thing, the garden. It is not necessary to apologize for the children's garden by showing how the idea may be correlated with all the rest of the curriculum. As I have before said, I fear that any such cut and dried treatment may take away the very naturalness and the life of the movement, and put out of sight the real kernel and highest purpose of the garden idea.

Another claim is often made that through the gardening a business instinct is developed. Examples of bright boys selling products, cornering the market, getting control of the other boys' crops, etc., are set forth as results. It is not denied that thrift may be developed, but it is not necessary to use the school or home garden to teach the bright Yankee boy how to do a commercial trick. There is enough of this spirit in the air to make it sufficiently contagious.

The real aim, it seems to me, is to create a love for the beautiful plant and shrub and to show the boy how to make a small plot of earth or yard serve as an economic aid to the home, not only in supplying vegetables but also flowers and beautiful surroundings, Children's gardens are not for the sake of the school or the subjects in the curriculum, but for the more important institution, the home, and for the sake of the children themselves. We aim to develop patriotic citizens, but

if a man loves his home it is not difficult to arouse his patriotic spirit in time of war. It is a higher type of patriotism which makes a boy love his home enough to have a desire to make it beautiful and wholesome within and without. Teach a boy or girl how to make a back yard beautiful and fruitful, how to make and keep a fresh and even lawn with its boundary of shrubbery, and you will have aroused a new interest in the home and with it a corresponding love therefor.

A community made up of such individuals and such homes will be wholesome and beautiful. The character of any place depends so much upon its homes, that any movement that tends towards their improvement will be worth the cost. My word of warning, then, is to be certain that children's gardens are never introduced until sufficient preparation is made to assure permanent success. Do not make the idea too pedagogical, thus diverting attention and interest from the real and living aim which it seems to me is to interest the child in the possibilities and beauties of nature through a knowledge of vegetable and plant life ; and, finally, utilizing this interest in beautifying the home and its surroundings. These experiences will not only react upon the character of the town, but also upon the life and character of the individual boy and girl.

PRESERVATION OF EGGS IN WATER-GLASS.

One of the most popular and commonly used methods of preserving eggs is by means of water-glass. Though this method was introduced only comparatively recently, it has largely superseded older methods, and appears to have led to the more frequent preservation of eggs on a small scale in households and by small traders. Usually eggs are obtained when they are plentiful and cheap in spring and preserved for use during the winter months, so that it is necessary to keep them for about six months. Some experiments as to the length of time they would keep without undergoing decay or any other serious change in composition was made by Mr. James Hendrick, B. Sc., of the University of Aberdeen, in which it was found that eggs which had been kept in water-glass for a few months could hardly be distinguished in appearance, flavour, and smell, either raw or cooked, from what are called "fresh eggs," that is, fresh eggs in the commercial sense, which may be several days old. The eggs which had been preserved in water-glass for about six months tasted and smelt like well-kept eggs a few days old. As the eggs in question were a few days old when they went into the water-glass, it did not seem that they were appreciably changed.

As the eggs get older, however, a distinct change occurs which can be appreciated both by the eye and palate. Eggs which have been three or four years in water-glass are easily recognised, The white becomes pink in colour and very liquid, and the eggs acquire a slightly peculiar taste suggestive of soda. At the same time, even when four years old, the eggs had no unpleasant taste or smell, and the white coagulated in the usual manner in cooking. The changes in the preserved eggs take place very gradually. At one year old they are hardly noticeable, at two years they are distinct, but not so distinct as at three or four years old.

An endeavour was also made to determine whether any distinct changes take place in the composition of eggs when kept in water-glass, and especially whether the soda and silica of the water-glass penetrate into the egg to any great extent. The general conclusion arrived at is that there is practically no change in the composition even from lengthened immersion, and that practically no silica, and very little, if any, soda, find their way into the eggs. A slow deposition of silica takes place in the shells, which blocks up the pores of the shells to some extent, and renders them less permeable.—*Journal of the Board of Agriculture*, February, 1907.

REPORT ON NUWARA ELIYA AGRI-HORTICULTURAL SHOW.

APRIL 2ND AND 3RD.

Class 1.—GARDENS.—In company with Mr. Neill G. Campbell and the Kachcheri Mudaliyar these were judged on 28th March. The first prize for the "best cropped and cultivated Market Garden in the Nuwara Eliya Board limits, paying assessment of R100 and over" was awarded to Mrs. W. O. Garth of the Darlington Gardens. Most of the grounds were well stocked with vegetables in all stages of growth, and the plot of land recently opened had an excellent crop of Cabbages and Cauliflowers. It would be well worth the while of the owners to use separate tools on this land and take other precautions to prevent the introduction of "Club root," which otherwise would rapidly spread and make a valuable piece of land almost useless for the cultivation of Crucifers. The second prize was awarded to P. D. M. Silva of Bambrakelly, but his garden showed want of cultivation, and, though told about it last year, little seems to have been done to keep in check the "Cabbage fly" by the use of Tobacco water.

There was one entry for the "best Nursery Flower Garden," but no prize was awarded. Mrs James Hill again carried off the prize for the "best cropped and cultivated Private Vegetable Garden," Great credit is due to her for the excellent condition it was in, and the systematic way in which it was cropped.

It was encouraging to find that there were seven entries for the "best Private Flower Garden." Lady Bois was awarded first prize, and Mrs. James Hill second. In the former's garden everything was in good order and the flowers were at their best, Phloxes and Verbenas being especially fine. Mrs. Hill's garden was exceedingly pretty, but hardly as good as last year. Mrs. Loos of Rossye Lodge was highly commended for her garden, which contained a profusion of bloom.

Class 6.—CUT FLOWERS.—Considering the severe frosts experienced during February, and the heavy rains of the following month, this class all round was excellent, and far superior to what anyone expected: in fact, though the quantity was perhaps less, the quality showed a decided improvement over last year. Special mention should be made of Mr. Neill G. Campbell's fine roses, which carried off five prizes out of the seven offered, and the Silver Cup presented by Mr. T. C. Huxley for the "best grown and most meritorious exhibit of any one variety of one flower." Also Mr. N. C. Rolt's collection of Cut Flowers, which was again awarded the Silver Cup presented by Mr. C. J. Bayley; it was a fine well-grown lot, and his African Marigolds were quite the finest yet seen in Ceylon.

The staging this year was much better, and the flowers were seen to more advantage.

Mr. C. J. Bayley's Violets and Camellias were very fine. Several of the sections in this Class did not fill, which is a pity, as from the gardens judged some very fine exhibits could have been sent. A large exhibit "not for competition" covering over 125 square feet was sent from the Hakgala, Nuwara Eliya, and Queen's Cottage Gardens, and was much admired.

GENERAL.—Taken all round there was much improvement this year except in the "Pot Plants" Classes. One or two additions and alterations should be made in the Catalogue for the next Show, and I think it would be well to add to the regulations to enable, amongst other things, the exhibitors to know exactly what to send, and all the Judges to act on the same lines etc.

J. K. NOCK,

Curator, Hakgala Gardens.

REPORT ON CLASS II: FLOWERS AND VEGETABLES.

Class II ("Garden Perennials in Pots").—Exhibits in this class were very scanty, though the articles displayed were on the whole of very fair merit. But these must not by any means be taken as examples of the best that can be grown up-country. It may be assumed that the paucity of exhibits is in this and similar cases largely due to difficulties of transport, and also to the fact that the owners do not feel inclined to risk their most valuable plants. With flowers and vegetables, however, it is different, and consequently there has been an excellent show of these.

In Class 2, only two indifferent lots of Geraniums of any kind were shown, which is proof of the above assertion. There were no exhibits of Pelargoniums, Cyclamen, Chrysanthemums, Azalea, Achimenes or Cactus, and but one Fuchsia, one lot each of Begonia, Gloxinia, and Freesia. Certain other awards offered, the meaning of which was not clear, were not competed for.

The feature of the Show as regards up-country productions were the English vegetables and flowers. Samples of Knol-kohl, Leeks, Parsnips, Carrots, Cabbages, Celery, Cauliflower, and Beet were shown which would compare well with those seen at shows in England. A dish of excellent Asparagus, rarely grown successfully in Ceylon, was exhibited by Mr. Thos. Farr of Bogawantalawa. It was noteworthy that not a single sample of the "Jerusalem artichoke" was staged. The failure of this excellent vegetable up-country is in striking contrast with the almost wild state in which its ally the "Globe artichoke" may be seen growing in up-country gardens.

H. F. MACMILLAN,
Curator, Royal Botanic Gardens, Peradeniya.

REPORT ON THE UVA AGRICULTURAL SHOW.

APRIL 26TH AND 27TH.

ESTATE PRODUCTS AT BADULLA.

Very little was shown under this head. The cotton was mostly short-stapled, but there was one good exhibit of Sea Islands. The tea was good, but rubber was only shown by one or two estates; the winning biscuits were excellent.

JOHN C. WILLIS.

LIVE STOCK SECTION.

I have the honour to report that I was present at the Badulla Agricultural Show on the 26th and 27th April, and helped in the judging of Live Stock. The exhibition of cattle was fairly satisfactory, particularly with regard to native cattle, with the exception of milch cows. It is highly desirable that the breeding and rearing of native milch cows should be encouraged, as these are scarce in the Sinhalese districts of the Island.

The gold medal for the best bull was won by an English Shorthorn stud bull belonging to Mr. Beattie. Almost all the prizes offered for Live Stock were well competed for, and all the prizes except two (viz. No. 11 offered for the best pair of cart bulls, and No. 16 for the best boar or sow) were awarded. Seven special prizes were offered for live stock, two by the Ceylon Agricultural Society for the best native bull and cow, one by the Society for the Prevention of Cruelty to Animals, for the best-cared for native bull, one by the Poultry Club for the best poultry, and the other three by private individuals, viz., Mrs. J. B. Cotton Mrs. S. H. Pearless and Mrs. J. Duncan, for the milch cow and the best fowls and ducks respectively. It is worthy of note that almost all these special prizes were restricted for competition by villagers residing in Uva.

I would recommend that a prize be offered in future shows for the best pair of native cart bullocks castrated at a demonstration held in the Province.

The ponies, of which there were six exhibited, showed that with a little more care and attention a good strain of country ponies can be bred in the Province.

The exhibition of poultry was quite satisfactory, considering the fact that it was done independently of the efforts of any Poultry Club.

E. T. HOOLE,
Acting Veterinary Surgeon.

Colombo, 1st May, 1907.

LIVE STOCK.

Apiculture in Ceylon.

By an Amateur.

There is as much difference between the terms *apiculture* and *bee-keeping* as between *horticulture* and *gardening*. We are all of us gardeners; but very few are horticulturists. And it is in the hope that I may induce a few bee-keepers to join the ranks of apiculturists that I write this. The bee-keeper merely keeps bees and robs them for the sake of their honey—of which he gets very little. The apiculturist, by adopting scientific methods, looks after the welfare of his stock, and, with far less trouble to himself, and without injuring the bees, secures probably ten times the amount of honey. And in addition to this, he has the pleasure of studying some wonderful facts of natural history.

I think there are three reasons why people do not go in more widely for apiculture. They fear the danger of being stung; they imagine the science to entail a great amount of trouble; and they think it must be an expensive hobby. Well, let me take these objections in their order. If a strong hive of bees made up its mind to attack its owner in a body, he would most likely be killed. In the same way, I would point out that, if you meet a rogue elephant at close quarters in a narrow jungle path, you will probably be killed; but this does not prevent you from walking along a jungle path whenever you are so disposed! And yet, no small number of persons have been killed by rogue elephants, whereas no bee-keeper has yet been killed by his bees.

The fact is, bees do *not* sting unless they are forced to—for the simple reason that, if they do, they die. You will, of course, if you keep bees, inevitably be stung now and then by an odd bee here and there; but the blood very soon becomes so inured to the poison, that you no longer feel any ill-effects beyond the prick.

As to the trouble involved in scientific apiculture, it depends on oneself. If bees are kept in a "chatty," there is, of course, nothing that one can do to help them on. But if a substantial crop of honey is looked for from a frame-hive, then the bees *must* be examined and fed now and then. But on the other hand, do not overdo it. Bees have been known to kill their own queen out of sheer anger (apparently) at being messed about too frequently. It is sufficient for a novice if he examines all the frames of each of his hives once a week. He can then see if the queen is alive, and whether she is laying properly; and he can guard against the wax-moth.

And finally, as to expense. A frame-hive naturally costs more than a "chatty"; but its yield in honey is more than proportionately greater. And in order to save you the expense of getting a hive shipped to you from abroad, I will proceed to give you instructions for constructing one yourself.

The Hive. (*Fig. 2.*)

Take some old packing-cases of half-inch deal and pull them to pieces. Make four boards, two of them 18$\frac{3}{8}$ in. by 8$\frac{3}{4}$ in., and the other two 12$\frac{1}{8}$ in. by 8$\frac{3}{4}$ in., and nail them together to form the sides of a box, being careful that the top edges of the boards lie flush, and that the ends of the two shorter ones overlie the ends of the two longer. If you have done this properly, you will now find that the *internal* dimensions of your box are 18$\frac{3}{8}$ in. by 11$\frac{1}{8}$ in. by 8$\frac{3}{4}$ in.

Make a second box in the same manner, the boards being two of them 21⅜ in. by 11½ in., and the other two 15⅛ in. by 11½ in., again making the ends of the shorter boards overlie the ends of the longer. Place the first box inside the second, and you will find you have a space all round between the walls of one inch, while the outer box is higher than the inner.

Now raise the edge of the inner box (by placing bricks or boards beneath it) until it comes level with the edge of the outer. Prepare two strips of half-inch wood 22⅜ in. by 2 in., and a third strip 14⅛ in. by 2 in., and with these cover the space between the walls along the two longer sides and one shorter side, nailing the strips in place; and over the other shorter side tack a strip of tin or zinc 2 in. wide. Your two boxes are now firmly joined together; and if you turn them the other way up, you will find the outer rises 2¾ in. above the top of the inner, and you have an entrance-hole for the bees along one of the shorter sides. This is the body-box.

The floor must now be made—a board 25 in. by 15⅛ in., and though not necessary, it is a good thing to attach legs to it. But *on no account* must you nail the floor-board to the body-box.

If you care to make things thoroughly finished, you can nail a small plinth round the three sides of the body-box (but not, of course, along the front side where the entrance-hole is) its upper edge bevelled and its outer edge hanging slightly below the level of the bottom of the box. Fig. 1 will give you a rough idea of what I mean. This plinth serves the double purpose of keeping the box in place on the floor-board and preventing rain from driving in between floor-board and body-box.

Now make the lift or riser. This is another box without top or bottom (and with single walls) of the same size as the outer body-box. Fix a plinth round its four sides, and you will find that it sits easily on top of the body-box.

And, lastly, make a roof of some sort, either gabled or flat; but if flat, it should, when in position, slope slightly from front to back, so as to carry off the rain. Tack a sheet of tin or zinc (such as is used for lining packing-cases) over it, and paint the outside of everything white—two or three coats. Your hive is now complete.

FRAMES. (*Fig. 3.*)

Unless you are handy at accurate joining-work, I would recommend that these be procured from one of the Industrial Schools in the Island. The size is as follows (outside measurements):—

Top bar	19″ long.
Frame proper	17⅞″ × 8¾″

or, to give details,

Top bar	19″ × ⅞″ × ⅜″
Side bars	8⅝″ × ⅞″ × ½″
Bottom bar	17⅞′ × ⅝″ × ⅛″

The above measurements will be found to give serviceable strength without making the frame clumsy, and the frames will take the W. B. C. metal-ends to which I shall refer. The top bar should, of course, project over the side bars ⅝″ at either end; and care must be taken that the frames proper are dead rectangles without any sagging.

You will also require two dummy-boards for each hive. These are plain boards 18½″ × 9⅛″ with a top bar the same as on the frames. These are used for the purpose of contracting the size of your hive in case your bees are not able to spread themselves over the eight frames that your hive will contain. And finally, you want

" quilts" with which to cover over the tops of the frames. Two or three thicknesses of flannel will be found as good as anything—about 19″ × 10″. These serve to keep the body-box warm and dry, and enable the apiculturist to uncover as many or as few frames at a time as he desires, which naturally facilitates manipulation. If the bottom quilt have a round hole cut in the middle, it will be found useful in case it be desired to place a *feeder* there to work up a weak stock into a strong.

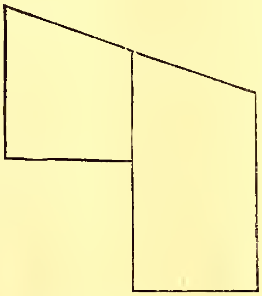

Fig. I.
Plinth (on large scale).

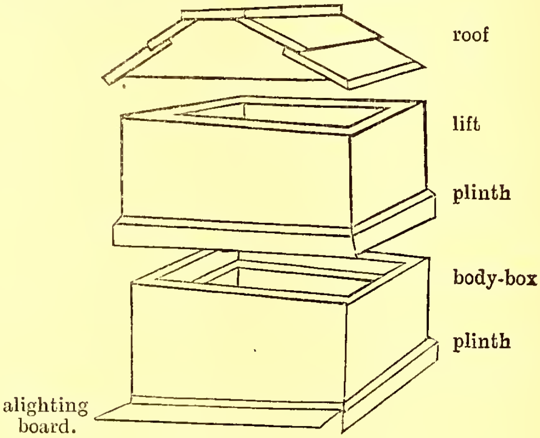

Fig. II.
Hive complete.

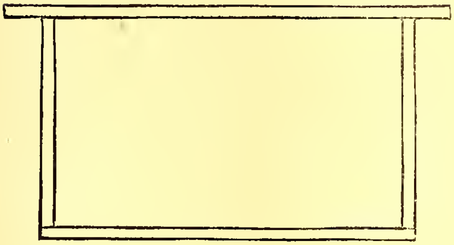

Fig. III.
Frame.

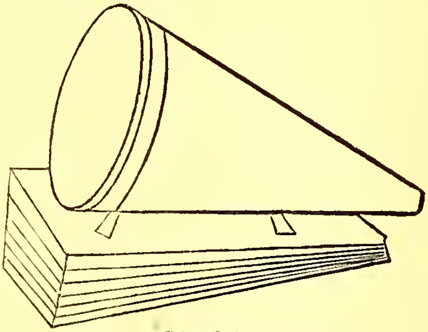

Fig. IV.
Smoker.

Your hive is now ready for the reception of the bees. But before going on to deal with them, I will give you a list of cheap appliances that you will find useful.

APPLIANCES.

If you get the following from England in one consignment, they can come by parcel post for one or two shillings :—

Feeder (1/6 to 2/9).—I would suggest a Wilke's Convertible at 2/9 as the most useful.

Smoker (1/6 to 4/6).—Get one that blows real smoke. Do not be put off with machines that puff the vapour of chemicals into the hive. A Clark's Cold Blast at 3/6 or a Bingham at 4/6 are good.

Foundation.—One pound, costing 2/, is ample to begin on. Order Natural-based brood foundation.

W. B. C. Metal Ends.—These are used for fitting over the projecting ends of the frames (but not the dummy-boards), so as to give accurate spacing between the frames. For European bees one should be placed at each end of *every* frame; but for the native Mee-Messa, they should be placed on every *alternate* frame.

Veil.—Can be made of of mosquito-netting, dyed black. If left white, the reflection of the light on the white threads dazzles the eyes. It should go over the hat and the other end be tucked inside the coat.

Gloves should not be worn. They only make you clumsy, and if one bee stings, they hold the scent of the poison, which infuriates the others. If, however, it is judged advisable to wear them for some special operation, an ordinary pair can be used, and the sleeves tied round the wrists with a piece of string to make everything bee-tight.

(*To be continued.*)

Correspondence.

THE AUSTRALIAN MAGPIE IN CEYLON.

A RECENT INTRODUCTION.

Sir,—Having turned loose the Australian Magpies I imported last year, may I appeal, through your paper, to the various branch Agricultural Societies in Ceylon to notify the headmen and others in their districts that these birds shall not be molested in any way. At present they are keeping about in this part; but I expect when the S. W. Monsoon breaks, they will move down into Uva.

The birds are easily recognizable, being rather smaller than the Ceylon Crow with plumage of black and white—or rather, black and silver. They have two notes—a harsh *caw* and a plaintive and melodious *warble*. The latter note may be heard almost any sunny morning by persons passing this house.

As these birds are extremely helpful to agriculture, devouring insect pests in great quantities, it will be useful if anyone, noticing their presence in other parts of Ceylon, will inform the Agricultural Society as to date and locality. Then, if we find that they are increasing, we can import and turn loose a further consignment.

They will not eat vegetable food in any form ; so that, if seen hopping about in gardens, they should not be driven away, as they will be clearing the garden of grubs. In view of this, I trust everyone will recognize that it is to his personal advantage to protect them in every way.

I am, &c.

H. CAMPBELL.

Yalta, Nuwara Eliya, 25th March, 1907.

TEPHROSIA AS A GREEN MANURE.

Dear Sir,—The weed *Tephrosia purpurea*, Sinhalese *pila*, Tamil (N. P.) *Káviláy*, is considered by the people of the Jaffna Peninsula to be an excellent green manure for tobacco. I am asked by one of them whether it would not do for tea as well. It is a very common weed, and one of its peculiarities is that it grows in the moist as well as in the dry regions. But in the former no use appears to be made of it as manure, whereas in Jaffna it is in great demand for this purpose.

J. P. LEWIS.

Kandy, 23rd March, 1907.

[It is one of the Leguminosae, and so will add nitrogen like Crotalaria.—Ed.]

USES OF "MUD-KILAVAI."

Dear Sir,—To mention one more use of the Mud-kilavai (*Balsomodendrum Berryi*), I have seen carved figures representing different Tamil types or castes made out of the wood, which is apparently fitted for this sort of work. They were sent to the St. Louis Exhibition.

J. P. LEWIS.

Kandy, 23rd March, 1907.

CEYLON PAPAIN.

SIR,—In view of numerous enquiries received with reference to the market value of this preparation from the papaw tree (*Carica papaya*), the following report from Prof. Dunstan on samples submitted last year by me will be of interest.

It may be inferred, however, from the fact that a local firm is buying a considerable quantity every month at a price somewhat over five shillings, that there are other good markets in the world outside England.

(Report referred to dated 27th July, 1906, annexed.)

C. DRIEBERG,

Colombo, 4th April, 1907. *Secretary, Ceylon Agricultural Society.*

(*Copy of Report referred to.*)

Imperial Institute, London S. W., 27th July, 1906.

SIR,—The two samples of Ceylon Papaw (papain) which were forwarded to the Imperial Institute with your letter No. 2055 of the 23rd of May last have been submitted to brokers for valuation, and I now forward the following information regarding them.

The brokers reported that the probable value of both samples (powdered and granulated) is about 5s per pound, but added that the demand for this material is very limited, They recommend that not more than 50 pounds should be shipped at one time.

Papain is regularly offered on the London market, but the sales are not large. On the 22nd July, 1905, a parcel realised the price of 8s 6d per pound, but since that date there is no record of any public sale. The material has not come into extensive use as a medicinal agent.

I am, Sir,

Your Obedient Servant,

(Signed) WYNDHAM R. DUNSTAN.

The Secretary, Ceylon Agricultural Society.

SNAKE-BITE CURES.

DEAR SIR,—Mr. W. A. de Silva, Veterinary Surgeon, Colombo Municipality, has communicated to me his success in the treatment of snake bite in the dog with the root of the papaw tree (*Carica papaya*), the application of the drug being external. It is worth remembering this as likely to prove useful in an emergency.

In this connection I should like to draw attention to Sir Lauder Brunton's simple method of destroying snake venom by means of permanganate of potash after scarification of the wound. To facilitate the treatment and place it within the means of all, chemists are now selling cartons, small enough to be carried in the waist-coat pocket, containing both permanganate and a little scarifying instrument. I purchased some at a big firm of druggists in Calcutta for eight annas (50 cents) each, and they could probably be had much cheaper if ordered in quantity from the makers.

These cartons should be available at cost price at all Government Dispensaries.

Yours truly,

C. DRIEBERG,

Colombo, 9th March, 1907. *Secretary, Ceylon Agricultural Society.*

THE ABSORPTION OF NITROGEN BY PLANTS.

DEAR, SIR,—I enclose a cutting from an Aberdeen paper *re* "Absorption of Nitrogen by Plants," which may interest some of your readers, in view of the recent correspondence there was on the subject, in the local papers. Mr. Trail is the Professor of Botany in Aberdeen University.

Yours faithfully,
J. M. URQUHART.

(*Extract from the Aberdeen Free Press.*)

I recognise Mr. Jamieson's right to hold his own beliefs as to the mode of absorption of nitrogen from the atmosphere, and I respect the sincerity with which he works, and the courage that he shows in upholding what he believes to be true, against what he considers to be of the prejudice that approaches persecution in the refusal to do honour to a prophet in his own country. I have examined carefully the evidence he has put forward in support of his views, and have formed my own conclusions on it ; but I have not felt called on to make a statement of these conclusions, apart from the bearing on my work as a teacher. But the reticence that was permissible from unwillingness to appear to prejudice Mr. Jamieson's investigations, and from feeling the uselessuess of controversy on a subject in which the evidence on each side can be of interest to only the few to whom study has made it more or less familiar, can no longer be maintained when Mr. Jamieson claims me as a convert to his views, even in part. I do not doubt his belief that I am so ; but it is only an example of the very slight grounds on which he is able to arrive at a conclusion favourable to his views. That belief rests on an absolute misunderstanding alike of what I said and of the problem that he is seeking to solve. With reference to his argument that a tree, after growing many years in a soil, left that soil not impoverished in nitrogen to a degree comparable with the nitrogen present in the tree, and that the plant itself must have drawn the excess directly from the atmosphere, I suggested that the argument was not conclusive. It did not take account of what I believe is admitted by everyone acquainted with the work of recent years on the microscopic organisms in the soil, namely, that by their action compounds of nitrogen are being constantly added to the soil, and brought within reach of the roots of green plants. It is generally held that plants do obtain nitrogen from the air in this way ; but this is absolutely distinct from Mr. Jamieson's claim that he has proved that green plants absorb it directly from the atmosphere, and that the young hairs are the organs of absorption. On this point, I think, after the most careful and unbiassed examination of the evidence that I could make, that he has failed to prove his case, and that he has so completely misunderstood the structures examined by him as to make impossible a true interpretation of their functions.

In what follows I shall look at and discuss his evidence only as a botanist, accustomed to the use of the microscope and of the tests employed, and familiarised by years of study with the structures of plants, and with the contents of the cells from their earliest to their mature stages, and also with the conditions under which plants grow, as learned by much time spent in studying them in their natural homes.

Turning to the mode of absorption of nitrogen that Mr. Jamieson claims to have discovered, it consists, so far as I can follow his descriptions and figures in the absorption of the nitrogen at the tips of the young hairs in cells which contain chlorophyll or the substance that gives the green colour to plants. This absorption, he supposes, leads to the production of nitrogenous compounds, which are carried down into the leaves at first in a fluid state by narrow tubes, or rather by a cylinder around the space ; and afterwards the more solid material passes down the centre of

the hair. He ascertained the presence of these nitrogenous compounds by the use of iodine as a test, confirmed by other tests. There is no question as to existence of nitrogenous substance in the young cells everywhere, since the living substance (protoplasm) of a plant, like that of an animal, is present in every living cell and suitable tests will show its presence; but that does not warrant the assumption that its presence proves the absorption of nitrogen from the atmosphere, and the formation of nitrogenous compounds in those cells. Nor is chlorophyll found in the young hairs, as Mr. Jamieson believes it to be. Such colouring matters as occur (as his figures represent them in certain hairs) diffused in the fluid contents of cells are quite distinct from chlorophyll; which in all flowering plants is always confined to certain sharply defined biscuit-shaped little pieces of protoplasm (chlorophyll-bodies or chloroplasts), imbedded in the colourless protoplasm of the cells that form the green tissues of leaves and other parts.

Coming now to the supposed channels by which the more fluid compounds pass down into the inner tissues, a careful study of Mr. Jamieson's drawings and explanations shows that the channels are neither more nor less than the cell walls, which assume a yellow colour with iodine, but are not hollow. One hardly thinks of the sides of a bucket as affording channels for the transference of the fluid it contains. As for the passage of the more solid materials down the central space of a hair made of a row of cells, the cell-walls that cross that space would seem to make the transference of solids somewhat difficult. I admit that I have found it difficult to understand some of the figures, for they differ from anything that I have seen in the examples of the same species examined by myself; but one figure bearing the explanation that it shows the channels that carry the fluid down from a hair to distribute it among the cells below the epidermal layer, appears to me to represent clearly by the channels the walls of palisade-cells, and by its so-called "cells" the chlorophyll-bodies lying in characteristic fashion, not touching one another, but in fact embedded among the colourless protoplasm within the palisade-cells.

I have to apologise for occupying so much of your space, and for the technical character of so much of the above, but it seems due to Mr. Jamieson to give reasons (though by no means all) for not agreeing with his assertion that "the mode of absorption was considered to have been demonstrated last year," or with the view that to accept the fixation of nitrogen by low organisms in the soil and on its surface "constitutes acquiescence in the main point" that he claims to have proved. The assumed mode of absorption, so far from being demonstrated, seems to me to rest on errors both of observation and of interpretation so fundamental that they vitiate his conclusions as to the functions of the parts in question. I am not, therefore, disposed to throw aside beliefs based on work of those whose methods I have been able to test, and have not found wanting in favour of Mr. Jamieson's views, however much I may respect his sincerity, energy, and determination. I should have left him to persevere without any such criticism of his views as this, had he not claimed me as accepting them. I hold there is much to be explained in the laws of life and nutrition of plants as well as of animals; that only ignorance can presume to dogmatise or to refuse to examine honest work on its own merits; but that it is incumbent on everyone who brings forward views opposed to those generally accepted as the result of honest and competent investigation to test the new views most carefully with full understanding of and experience in the best methods of investigation. There is no desire so far as ever I have seen, to refuse new views a fair hearing, but if they claim to prove the falsehood of those already held they must themselves be fit to stand the severest tests of inquiry and criticism. To say that Mr. Jamieson's appear not to stand these tests is not to commit oneself to the assertion that the relation of the atmosphere to plant life is yet fully understood. That relation is deserving of close and continued investigation.—I am, etc.,

JAMES W. H. TRAIL.

AN ESSAY ON THE BETEL VINE.

ITS CULTIVATION AND DISEASES.

Mr. M. H. Mirando, Hon. Secretary of the Negombo Branch Agricultural Society, and Muhandiram of Alut Kuru Korale North, has offered a gold medal through the Parent Society for the best essay in English, Sinhalese or Tamil, dealing with the cultivation of the betel vine--soil, planting, manuring, pests and diseases—their prevention and cure—with a view to obtaining the experience of cultivators and others conversant with the subject. The Secretary, Ceylon Agricultural Society, is prepared to receive essays till the end of June. It is expected that the Government Mycologist will shortly issue a leaflet dealing with the subject of betel disease, and the exhaustive information which it is hoped to get together through this competition will probably prove of value in the preparation of the leaflet.

In view of the great risks to which so remunerative an industry as betel cultivation is exposed, and the heavy loss occasioned by the disease or diseases affecting the vine, the offer made by Mr. Mirando is one which the Society is only too glad to accept in the interests of the numerous small cultivators who make a living out of betel growing, and it is to be hoped that with the assistance of the liberal donor of the prize and the technical advice of the Government expert in plant diseases, it will be found possible to carry on the cultivation with less uncertain prospects than at present.

Minutes of the Board of Agriculture.

The thirty-first meeting of the Board of Agriculture was held at the Council Chamber at noon on Monday the 6th May, 1907.

His Excellency the Governor presided.

The others present were :—The Hon. Mr. H. W. Brodhurst, the Hon. Mr. H. L. Crawford, the Hon. Mr. P. Arunachalam, Mr. J. Harward, Dr. J. C. Willis, Mr. E. B. Denham, Mr. Francis Beven, Mr. E. T. Hoole, and the Secretary.

Visitor :—M. Suppramanian.

BUSINESS DONE.

1. The Minutes of the Meeting held on April 8th, 1907 were read and confirmed.

2. The Progress Report (No. XXX) was presented and taken as read.

3. The Report on the Southern tour made by the Organising Vice-President and the Secretary, printed in circular form, was laid on the table. Dr. Willis, at the request of His Excellency, supplemented his minute on the report by some further remarks on the respective functions of town and village Agricultural Societies.

4. Reports by Mr. J. K. Nock and Mr. H. F. Macmillan on the Nuwara Eliya Show, and by Dr. Willis, Mr. Nock and Mr. Hoole on the Badulla Show were tabled.

5. The Secretary read a paper entitled "A note on the new system of cultivation in arid districts."

Dr. Willis emphasied the necessity for cultivation, in the true sense of the term, as the only means of conserving moisture in dry districts.

His Excellency the Governor also commented on the paper, remarking on the importance of the points raised.

6. Dr. Willis then addressed the meeting on the subject of a Rotation of Crops suitable to Ceylon.

His Excellency in the course of his remarks suggested the possibility of improving the method of cultivation in vogue on high lands, by allowing Crown land to the poorer villagers on reasonable terms, to be cultivated according to a rational system of rotation.

Agricultural Society Progress Report. No. XXX.

Membership.—Since the last meeting the following members have joined the Society :—W. M. Wade Gery, W. L. Fernando, W. G. Fernando, W. Elaris Fernando, W. Timothy Fernando, and G. E. Bewley. The following Branch Societies have been established and will shortly be affiliated to the Parent Society :—Wanni hatpattu, Ambalanwatta.

Branch Societies.—Mr. N. Wickremeratne, Agricultural Instructor, who lately visited Ambalangoda to investigate the causes of reported failure on a rubber plantation there took the opportunity to convene a meeting at Ambalanwatta, with the aid of Mr. H. Napier Dias, planter, on the 19th April, when a committee was formed to carry out details in regard to the formation of a Branch Society at Ambalanwatta, a district close to Galle. Mr. Napier Dias acts as Secretary *pro tem.*

At a meeting of the *Wanni Hatpattu Branch,* held on the 12th January, a resolution was adopted to the effect that tobacco cultivation be taken up on a large scale so as to make it the staple product of the pattu ; it was also agreed that influential members of the Branch Society should make every effort to give cotton cultivation a fair trial in order to find out the suitability of the crop to the district, and whether it could be remuneratively grown.

The *Katana Branch* held a meeting on the 5th April, at which it was decided to hold an Agri-Horticultural Show in November next. As the Katana district proper is of limited extent, it was agreed to add Otara West and Godakaha Vidane divisions to the area from which exhibits will be drawn.

A suggestion has been made by the Secretary of the Negombo Society that the Katana and Negombo branches should be amalgamated, but the matter has not yet come before a meeting.

The *Trincomalee Society* held a Market Fair on the 2nd April which was a great success.

The Organizing Vice-President and the Secretary met the members of the Batticaloa and Badulla Branch Societies on their recent visit in connection with the cyclonic disaster in the Eastern Province. At a meeting convened by the local Secretary at Batticaloa on the 22nd April, the Chairman (Mr. Hopkins, Government Agent) presided, and there was a fair attendance. Addresses were given both by the Organizing Vice-President and the Secretary. There seemed to be a general wish that an experimental garden should be established in Batticaloa, and the matter will be taken up before long.

The Agri-Horticultural Show at Badulla was well organized, and all exhibiting sections were well filled. It was formally opened by His Excellency the Governor at 4 p.m. on the 26th April and continued on the 27th. The Society offered two prizes of Rs. 25 each for the best native bull and best native cow. Dr. Willis addressed a gathering on the Show grounds on the 27th April.

The Organizing Vice-President and the Secretary intend starting on a tour of inspection in the Northern Province. Opportunity will be taken during the visit to convene meetings of Branch Societies at Jaffna, Mullaittivu, Vavuniya, Anuradhapura, Kurunegala, and Kegalla.

The Central Agency.—It has been decided to hold an experimental sale of produce in Colombo on the 28th instant and a sale of cattle on the 31st, Mr. A. Y. Daniel acting as agent in Colombo. The sale of produce will probably be held on a spot close to the Municipal Market in the Price Park. The sale will include any kind of produce sent by Branch Societies and members who desire to try the Colombo market.

Experiments at Maha-Iluppalama Experimental Garden.—The Superintendent reported in January that 14 plantain trees of different varieties and 69 fruit trees of various sorts are established. One-fifth of an acre is under chillies and half an acre under cholam (Sorghum), 17 acres under rubber, and 50 under cotton. Tobacco is in the nursery, and 5 acres of land are ready for planting as soon as the time arrives.

Cotton.—Messrs. Geo. H. Brown & Co., Liverpool, writing to the Hon. Mr. Crawford on the 21st March, say :—" You will remember our writing to you early in the year about some samples of Ceylon cotton sent to us by the Ceylon Agricultural Society. We remarked on the cleanliness and bloom of the cotton shown in the samples, and pointed out that the value of the cotton in bulk (which we placed roughly at 9*d.* per lb.) would depend on its equality to sample, and that for trade purposes evenness of quality was of the first importance. The other day Mr. C. . . . . . . showed a sample of a consignment of four bales (from Ceylon). The four bales were of four different qualities varying in value by pence per pound, and not one recognizable as the same cotton as that shown by the Ceylon Agricultural Society's samples in our possession. It is obvious that care will have to be taken to produce a more even quality in bulk before a variety of cotton new to the market can obtain a footing here."

Mr. M. Suppramanian, broker, Colombo, announces me that he is prepared to purchase any quantity of spinning cotton and silk cocoons from one pound upward.

Sisal Hemp.—The Government Agent, Northern Province, writing on the 3rd April, reports :—" 150 plants were planted at Iratperiyakulam in Vavuniya South. Owing to the rocky nature of the ground they were planted irregularly, 8 and 6 feet apart, in a plot of ground 40 yards by 20 yards. These plants have done well so far. 150 plants were planted at Kanagarayankulam and Panikkankulam in the Vavuniya North division. Of these only 53 survived, 35 at Kanagarayankulam and 18 at Panikkankulam. These plants were planted 8 feet apart in an area of about one-eighth of an acre. They are doing well. 30 plants were planted in Delft in a plot of ground 2 lachams in extent (one-eighth acre). They were planted in manured holes 8 feet apart. They are doing well. The plants were obtained from the Director, Royal Botanic Gardens, Peradeniya, and were six to eight months old, some perhaps ten months, when planted."

Rubber Cultivation at Ambalangoda.—Mr. D. F. de Silva Jayawardena of Ambalangoda reported the failure of rubber plants in his Nagaskele estate, one and a half mile inland from sea at Ambalangoda. An Agricultural Instructor was sent down to investigate the cause and secure specimens of affected plants and also of soil for purposes of analysis. The matter is in the hands of the Botanic Department.

Sapodilla Seed from Bangalore.—A small supply of sapodilla seed has been received from Bangalore, and is now available to Provincial Road Committees for planting in the resthouse premises. The cost is 30 cents per dozen.

Bellary Onion.—Seeds of this onion have been received from India. A few half-ounce packets at 30 cents each are still available. Applications should be sent in at once.

Nepaul Chilli.—It is proposed to import a small quantity of this variety, inquiries for which have been received.

Essential Oils.—Mr. B. Samaraweera of Weligama has submitted an elaborate scheme for experiments under this head. The matter is under consideration.

Ceylon Rice in the West Indies.—A report has been received from Demerara on the results of experiments made with Ceylon varieties of paddy. This will be published in the Society's Magazine for general information ; but it is to be gathered from the report that none of the varieties imported can be recommended as substitutes for local varieties.

Kiushu Paddy.—The Ratemahatmaya of Walapane reports that he was successful in getting seven bushels of paddy from half a bushel sown. The Ratemahatmayas of Uda Hewaheta and Kotmale, and President of Village Tribunal, Uda Hewaheta, report failure in their districts, and they seem to think that the local conditions are not suitable for this variety.

Apiculture.—Mr. M. Shanks, writing on the 8th April, says :—"The honey is just beginning to come in. I have one hive on scales ; yesterday I sat down beside it and watched the weight going up ; from 8 a.m. till noon they gathered exactly one pound. I have other hives doing better, but they are not on scales."

Castration of Cattle.—The Acting Government Veterinary Surgeon reports : —"I have the honour to inform you that five demonstrations were given during March and the latter part of February last, at which 48 head of cattle belonging to 38 owners were operated upon, and three men trained. Two of these demonstrations were held in Kegalla in the Province of Sabaragamuwa, where 14 head of cattle were operated upon ; 2 were held in Nuwara Eliya District, 20 cattle operated upon ; 1 in Wellawaya, 14 cattle operated upon. Demonstrations have been arranged for in the North-Western, Northern, Sabaragamuwa, North-Central, and Southern Provinces. An extensive programme for castration of cattle, both by Stock Inspectors and the locally trained men, has been drawn out for the North-Western Province."

The total number of cattle operated upon this year up to end of April is 56 belonging to 40 owners, and three men have been trained.

Publications.—Mr. A. E. Rajapakse, Mudaliyar, Katunayaka, has subscribed for 25 copies of the "Govikam Sangarawa," to be distributed among the villagers

Fertilizers for Experimental Purposes.—The artificial fertilizers distributed by Messrs. Freudenberg & Co. among members of the Society for experimenta purposes during last year amounted to 75 cwts. representing a cost of Rs. 296.13. The fertilizers were given by the firm free of charge.

Agricultural Shows.—The following are the fixtures under this head :—

Telijjawila	May 15 and 16
Welimada	May
Matale	June 21 and 22
Colombo	June
Kegalla	June 28 and 29
Dumbara	August
Katana	November
Mullaittivu	Empire Day

C. DRIEBERG,

May 6th, 1907. *Secretary, Ceylon Agricultural Society*